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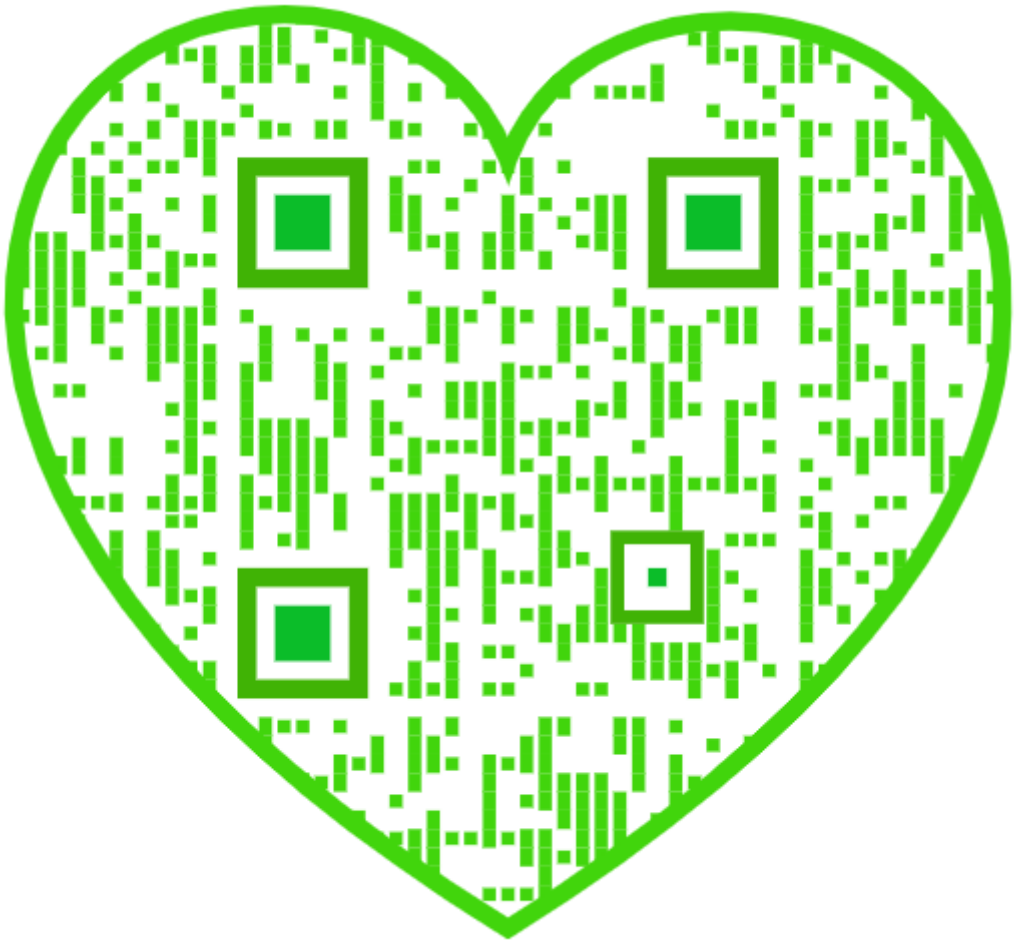

Water and Sewage Works

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# MUNICIPAL ENGINEERING

**The World's Leading Municipal Publication.**

THE MINNEAPOLIS PARK SYSTEM.
Bathing Beach at Lake Calhoun.

VOL. XLIV. JANUARY, 1913. No. 1.

Nothing has such power to broaden the mind as the ability to investigate systematically and honestly all that comes under one's observation. The function of this publication is to place before its subscribers articles of such importance and value that their knowledge may be enriched by reading about the accomplishments of others in the same and allied fields of endeavor.

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KANSAS CITY PARK SYSTEM.
TRAFFIC ROADWAY, ON THE LEFT.
PENN VALLEY PARK, BOULEVARD, AND HEAVY

KANSAS CITY PARK SYSTEM.
PASEO BEFORE AND AFTER IMPROVEMENT.
SUNKEN GARDEN. BEFORE IMPROVEMENT.
WALK. LAKE.

KANSAS CITY PARK SYSTEM.
Swope Park Entrance and Shelter House.
Public Bath House. Gladstone Boulevard.

JAMES H. LOWRY, the executive officer of the Department of Public Parks, of Indianapolis, Ind., is a young man, a graduate of Purdue University, Lafayette, Ind., and for four years a member of the faculty of that institution. He has had experience in the construction of concrete buildings and in heavy railroad construction as engineer, and is giving eminent satisfaction as an executive officer under the general supervision of George E. Kessler, the landscape architect, and the direct charge of the members of the Indianapolis Board of Park Commissioners. His clear statement of the organization and results of Mr. Kessler's work in Kansas City shows that he has a large view of the work in which he is engaged.

UNDER the old feudal system, which flourished during the mediaeval history of Europe, the manor or castle naturally became the center of culture, the court the retreat of the philosopher, the poet, the artisan and the artist. Money was expended lavishly to beautify the exterior and interior of the edifice and the surrounding grounds became the canvas on which the landscape artists and gardeners worked out their dreams.

As the city might be presumed to be the outgrowth of these early centers, likewise, we imagine the modest efforts of these early gardeners to be revealed and expressed today in the magnificent park and boulevard systems in the modern European city, which pay a silent tribute to the temperament of the citizens.

Tourists in visiting the continent are deeply impressed with the universal interest in city planning and beautification. Millions are spent in carrying the beauties of nature to the hearts of the cities and the conservation of streams, the establishing of playgrounds and parks become logical and important parts of the city growth.

America has focused her intellect and energy upon commercial and industrial development of the cities, and the general recognition of civic beautification has been noticeably lacking.

The good roads movement, the city planning leagues and improvement associations, supported by a liberal-minded minority, have been instrumental in educating the public to the necessity of parks

and boulevards, and in some states legislation favorable to this movement has been enacted. As a result of this impetus many American cities boast of systems which are close rivals to those of their sister cities across the Atlantic.

Kansas City is an excellent type of this class, justly priding itself on a system in the logical sense of the word. Parks, parkways and playgrounds, embracing about nineteen hundred acres, are tied together in a very unique manner by a chain of boulevards over fifty miles in length. With only about three hundred thousand population, ten million dollars has been expended on the park development, or about thirty-five dollars per capita.

The topography of the city is ideal, being very rolling, thereby affording an excellent opportunity for a series of upper and lower side-hill drives, which have been worked out very nicely. The picturesque and famous side-hill Cliff drive, about four miles in length, with its rugged vine-clad cliffs of native limestone rising sixty feet from the roadway, overlooking the broad lowlands of the Missouri, the Paseo with its formal schemes of planting, the playgrounds dotting the city, and the smaller parks, all are pleasant surprises in a trip over the system. Swope Park a large part of which is still undeveloped, has wonderful opportunities, and already has a very fine shelter house, numerous lakes and playgrounds and a well-stocked zoo.

### History of Development

The first steps in the development were taken in 1892, when the first Board of Park Commissioners, consisting of five members, was officially appointed. These men, all of high integrity and enthusiastic for city betterment, began a vigorous campaign to arouse public sentiment and to form a stable organization.

KANSAS CITY PARK SYSTEM.
West Pennway, Looking Northeast. Sarco Asphalt Macadam in Foreground. Bermudez Asphalt Macadam in Background Beyond Street Intersection.

There being no specific tax for park purposes and no well-defined executive powers vested in the board, the progress of the work was somewhat retarded. Nevertheless, a general plan under the direction of one of the country's most competent landscape architects, was then evolved and signs of life were soon apparent.

The phenomenal increase of population and a growing public sentiment in favor of the plan resulted in a clamor for special legislation. In 1908 an article was inserted in the city charter reducing the

KANSAS CITY PARK SYSTEM.
Tenth Street and West Terrace.
Before Improvement. After Improvement.
Cliff Drive.
Before Improvement. After Improvement.

number of commissioners to three, and defining the powers and jurisdiction of the board. This article provided for the acquisition of property by assessment and fixed a tax rate for general improvements and maintenance. The city was divided into park districts and internal improvements are assessed against the several districts for the improvement made within its boundaries.

### The Acquisition of Property

The Board of Commissioners desiring to obtain certain lands for establishing parks, for opening and widening streets or constructing boulevards, makes its recommendation to the city council, which in turn passes an ordinance to acquire the necessary property, prescribes the method of assessment and the several zones benefited by said improvement.

A certified copy of the ordinance is filed with the clerk of the Circuit Court, who immediately fixes a time and place for empaneling a jury to award damages and benefits and to make necessary assessments to pay for property taken. This jury consists of six men, except in cases where the property to be acquired is owned by incorporated companies. All such corporations are entitled, upon request, to a common law jury. This jury, after due deliberation and due consideration of details, renders its verdict, which, if regular, is confirmed and the property is taken. The Circuit Court verdict is final, unless some irregularity is proven.

Park certificates or bonds may be issued in the ordinary manner. Much litigation is thus avoided, and the board is enabled to proceed unhampered by unscrupulous real estate agents who inflate values.

### Organization

The agent largely responsible for the general appearance and the excellence of construction is the efficient, well-disciplined organization which has grown up under the supervision of the board.

The landscape architect who acts in a consulting and advisory capacity has worked out the detailed plan of the sys-

tem and has personally supervised the development since the inception of the plan. The work has thus been prosecuted along the broad lines necessary, and the numerous mistakes in policy and architecture, so noticeable in private work, are absent.

The superintendent, who is the executive officer of the board, directs the operations in the office and in the field, thru the heads of the various departments, among which are the clerical, engineering, construction, maintenance, operating and playground.

The secretary, assisted by accountants, stenographers and clerks, assumes responsibility for the accounting, records, cost-keeping, and all general clerical business. Special care is used in the distribution of labor and material expenses in all construction and maintenance. This affords excellent opportunity for intelligent study as to economical management.

The engineer of construction has supervision of work done under private contract, which naturally requires a corps of competent inspectors. These inspectors are young engineers or men who have had experience in engineering or contracting.

Thru this department the superintendent has been attempting to determine experimentally, from the standpoint of economy and efficiency, the roadway best adapted for boulevard traffic. The large local deposit of limestone has naturally resulted in the predominance of the macadam type of construction. The park department has about one million square yards of macadam pavement and one hundred thousand square yards of sheet asphalt. In this experimental construction various sizes and depths of stone have been used and numerous binding materials with various kinds of screenings in finishing.

The following table shows some of the types in use:

| | Bottom Course | | Second Course | | Third Course | | Finish | |
|---|---|---|---|---|---|---|---|---|
| | Size in. | Depth in. | Size in. | Depth in. | Size in. | Depth in. | Binder | Gals. Per Sq. Yd. |
| A | 3 x6 | 6 | 2½x3½ | 4 | ..... | .. | Road Oil | ½ |
| B | 2½x3½ | 6 | 1½x2½ | 4 | 1x2½ | 2 | Tarvia | 2 |
| C | 2½x3½ | 6 | 1½x2½ | 4 | 1x2½ | 2 | Sarco | 2 |
| D | 2½x3½ | 6 | 1½x2½ | 4 | 1x2½ | 2 | Texaco | 2 |
| | | | | | | | Bermudez | |
| | | | | | | | Pioneer | |
| E | 2½x3½ | 7 | 1½x2½ | 5 | ..... | .. | Oil—92 sp. g. | 1½ |
| | | | | | | | Oil—94 sp. g. | ½ |

Two of these types are worthy of especial note, the water-bound macadam with the oiled surface and the asphalt macadam.

In the former the bottom course is usually six inches in depth and consists either of hand-broken stone up to six inches in greatest dimension, or a crushed stone 2 inches to 3½ inches. The second course is usually about four inches in depth, and in size varies from 1½ to 3 inches. This course is water-sealed by using a fine dust on the surface, usually about 1½ inches, flooding with a sprinkling wagon and rolling until a uniform closed surface is exposed. This is broomed and left for about forty-eight hours, ordinarily, to dry. Then an application of road oil with an asphalt base is used, about one-half gallon to the square yard and a layer of fine limestone or granite screenings cast on the surface to absorb excess oil. This road is not designed for heavy traffic, but under light traffic gives excellent service.

The late road construction requires a bottom course of hand-broken stone, ranging in size from 3 to 6 inches, compacted by rolling to a depth of 6 inches; and second course of 4 inches, running in size 2 inches to 3½ inches. This course is water-sealed and then a third course 2 inches in depth, of 1 to 2½-inch stone is applied. This course is treated with an asphalt binder by the penetration method, 1½ gallons first applied, covered with Joplin grit, rolled, and then a paint coat of one-half gallon applied and the final coat of grit, and the surface thoroughly rolled. This road is adapted to all kinds of traffic and will undoubtedly be widely used.

The department has several large operating plants, which are equipped with spacious wood shops, paint shops, machine and repair shops, and owns much road building machinery, such as rollers,

melting kettles, distributers, rock crushers, etc.

The assistant superintendent has charge of all construction work completed with the park labor and equipment. His work is directed thru district foremen who have certain boulevard mileage to maintain. Road repair, road oiling, general maintenance of parks, bath houses, playgrounds and operating plants naturally belong to this department.

The public bath house and the outdoor swimming pool are growing in favor and are used by thousands every year. The bath house in the congested or tenement district has proven its usefulness, and other houses are being planned.

A small engineering corps is maintained to do preliminary work and make final location. A small office force of draftsmen under the chief works up notes and maps and prepares estimates.

In 1910 a lady was appointed as supervisor of playgrounds and under her intelligent direction the playground has become a training school. Directors who have had experience in physical culture, kindergarten or playground work are employed on the various grounds and a regular daily program of instruction is followed. The proper use of playground apparatus, fold dancing, basket weaving, story-telling and various games adopted to the playground are features of this system.

A close study is made of the individual and his home environment, and an effort made to teach habits of honesty and cleanliness. Clubs are formed at each playground and meetings are held during the winter months. Every effort is made to keep the children off the streets and to popularize the playground centers.

The Juvenile Court record shows that a large percentage of the children are kept off the streets and that there has been a great decrease in juvenile crime since the present recreation centers have been established.

Kansas City has kept pace with the progressive American city in creating a municipal civil service commission which fills all formerly appointive positions by competitive examinations.

The "merit system" has superseded the old "spoils" plan of distributing patronage and has eliminated much incompetency from all city departments.

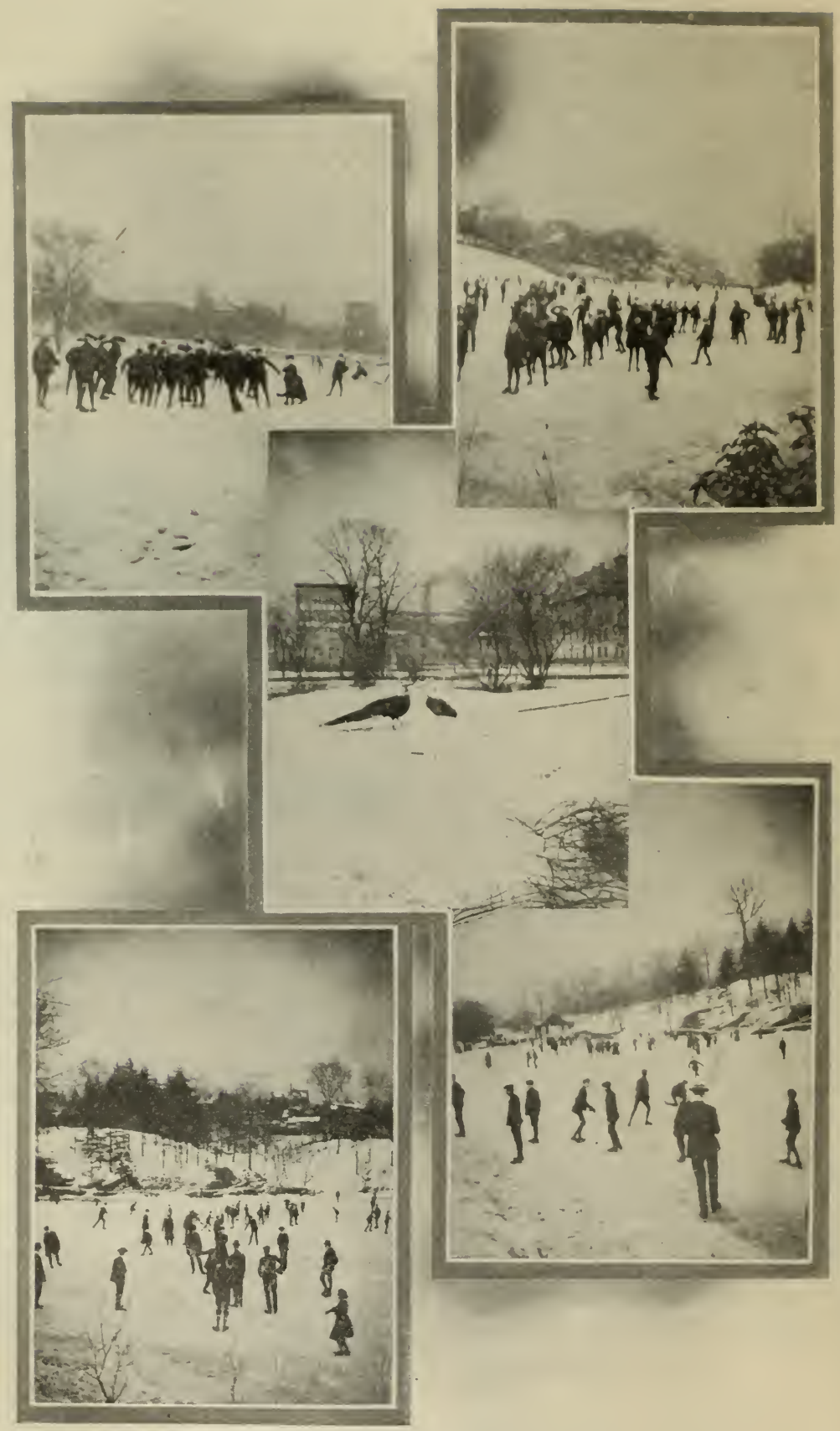
The interesting feature in the Kansas City park development is that it is on broad, sensible, natural lines, and wherever it has extended property values have increased. This fact is so generally recog-

THE KANSAS CITY PARK SYSTEM.
Memorial to President Meyer of First Park Board.

nized now that the parks and boulevards are of first consideration in laying out new additions.

Thus as the city expands the boulevards and parks will occupy a prominent place in each development and there will be an unconscious growth.

With ten millions well spent and more millions awaiting to develop the little valley of the Blue River, a small tributary of the Missouri, we can readily predict that this park system is destined to become recognized as one of the best in the world.



CINCINNATI'S PLAYGROUNDS.
Skating on Park Ponds and Lakes.

# CINCINNATI'S PLAYGROUNDS.

CINCINNATI'S PLAYGOUNDS.
Hanna Park Playground.

NEARLY all of the playgrounds of the city of Cincinnati, Ohio, have been developed within the past four years, but their extension has been rapid within that time and in 1912 there were nine children's playgrounds in operation under play instructors, in addition to several ball fields under less constant and detailed supervision. There are several new playgrounds, the sites of which have been purchased and the improvement of which is now in progress. All of these playgrounds are in charge of the Board of Park Commissioners and without connection with school buildings, and most of them are in separate locations, but few being located on or adjacent to parks, large or small. There are now twenty-two of these sites, thus providing quite generously for the children when the improvement of all of them is completed.

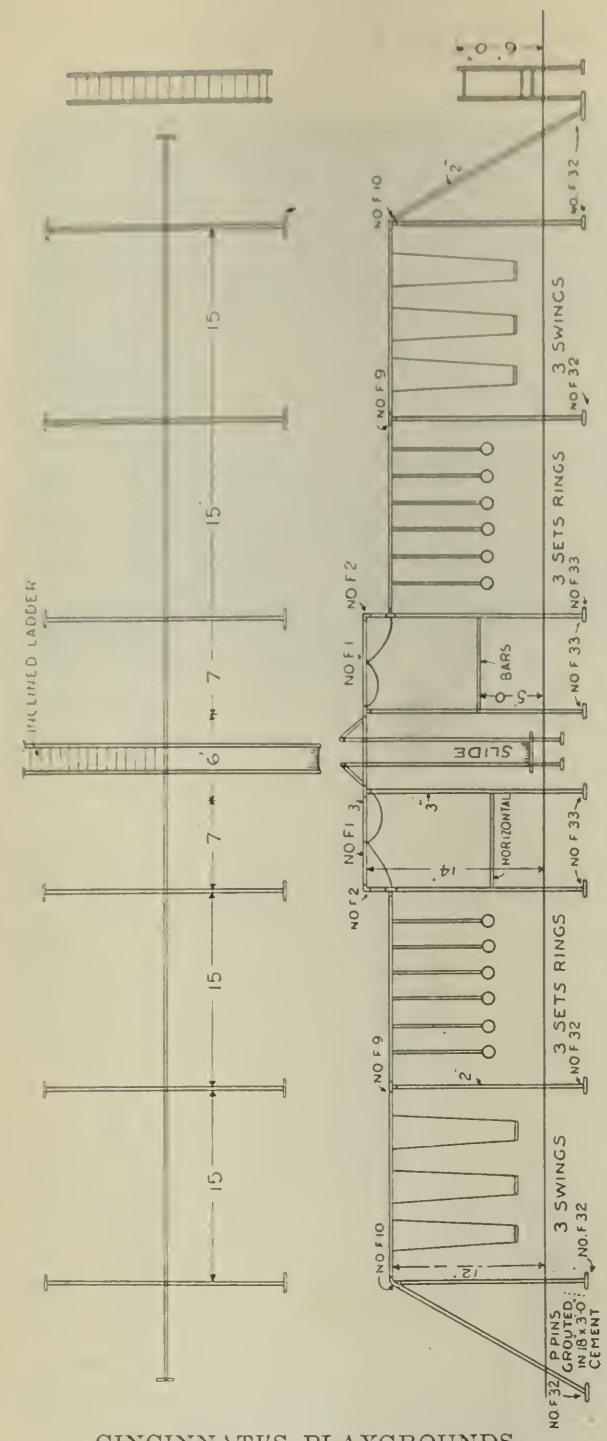
### One-Third of Park Money Invested

During 1911 and 1912 the proceeds of a million-dollar bond issue have been available for park and playground purposes, and $963,241.75 have been spent, and practically 25 per cent. of the amount has been spent in the acquisition and improvement of playground properties for the small children, and an additional 10 per cent. has been spent for athletic grounds for the larger children and young men and women, making 35 per cent. for such active recreation purposes as compared with 65 per cent. for park purposes proper.

### Value of Investment Demonstrated

Some idea of the cost of the property required for playgrounds may be gained from the report that the 7 properties bought during the past two years cost from $3,300 to $64,700, averaging a trifle less than $25,000 each. Sinton Park, which is located in a downtown district, has 2.33 acres area and the land alone cost $255,865, according to the report of 1908. The total cost of this park was more than $300,000. But it had 125,155 patrons during the season of 1912, and according to the probation officer, has reduced juvenile delinquency 67 per cent. in its neighborhood. Its value as an investment is fully demonstrated.

Nearly all the playgrounds and a few of the athletic fields are located in the congested districts, where they are most needed. It is the opinion of the director of playgrounds that one should be located for each 20,000 of population in




CINCINNATI'S PLAYGROUNDS.
I. Plan and Elevation of Standard Set of Apparatus.

such manner that it can be reached by five-minutes walk from any point in the district. This can be done in the congested districts and can be approximated in any fully settled area.

### Playground Equipment

The improvement on a playground consists of grading, placing a surface on the play areas, some simple apparatus, a wading pool and a building having dressing rooms for boys and girls, toilet rooms for each, a care-taker's room and porticos or spaces with awnings over them. If skating or sliding space is available there is also a room for a heating plant that the building may be used the year round.

The preparation of the surface of the playground is a problem which must escape on the one side the hardness which seems to be necessary for durability, and the brevity of life on the other side, which accompanies the elasticity of the ideal surface from the children's point of view. Cincinnati's experience has led to the recommendation of the following specification:

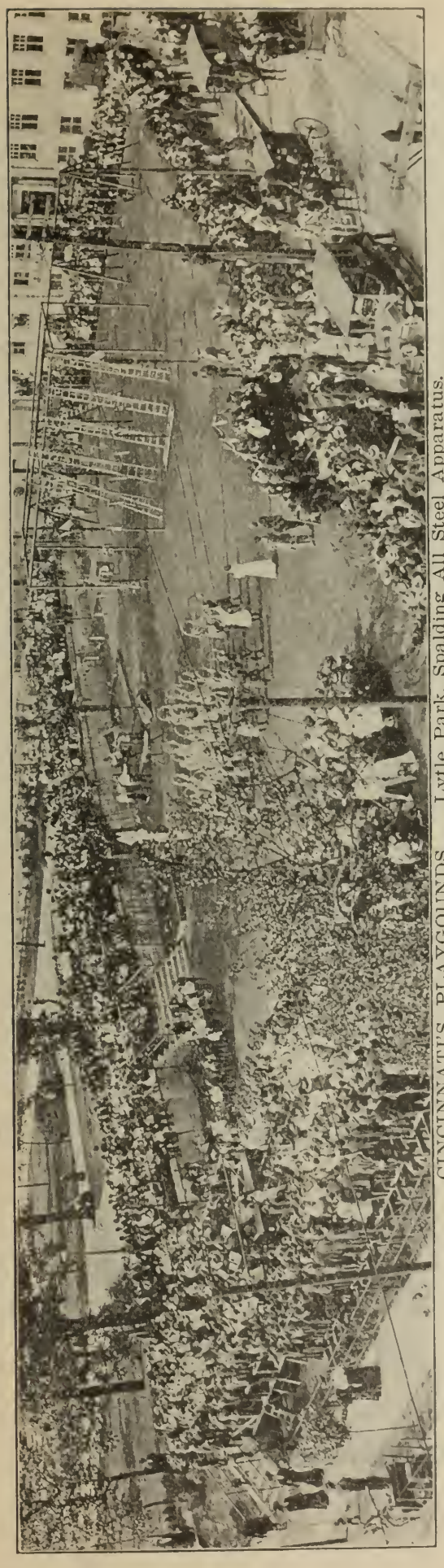
"Three to four inches of coarse cinders, well packed and rolled, covered with one to two inches of screen cinders mixed with equal parts of good clay, dampened and well rolled, will make an ideal play surface for athletic fields, running track, tennis courts or any other part of the play field. Such a mixture packs well, is springy, does not get dusty in dry weather, and can be played on in the rain."

Cinders mixed with tarvia have been used on some grounds with reasonable success. This surface is rather expensive, costing about 25 cents a square yard, including all material and labor, but not including the grading. It is reported that the surface is rather hard, the softening of the tar in hot weather not making the surface elastic and having a tendency to expose the corners of the particles of cinder.

Oiling the surface has not proven satisfactory, the principal complaint being that the children's clothes become very dirty and cannot be washed clean.

### Standard Play Apparatus

The equipment of playgrounds for small children should be as simple as possible. The accompanying drawings show the standard adopted for Cincinnati. It is modified to suit the area available and the number of children to be served. The stand shown will cost in place from $480 to $550 if constructed according to the Cincinnati system. The fittings are purchased from the manu-



CINCINNATI'S PLAYGOUNDS. Lytle Park, Spalding All Steel Apparatus.

facturers; the piping for the frames is purchased in the city, cut to fit and made ready to set up; the concrete foundations are laid and the apparatus is put up by day labor. A concrete block six feet wide is recommended for location under each section of the frame, the place of greatest wear being the strip of this width under the swings and rings.

### Buildings

The usual building of three rooms with two porticos, including all plumbing, glazing, plastering, painting, etc., the wading pool and cement paving, costs about $7,200, with extremes of $6,500 and $10,000. Under the porticos are located the sand-boxes and swings for the babies and the benches for their mothers. The standard equipment is 6 canvas hammocks and 6 swings.

### Wading Pools

After trials of several forms of wading pool, when 16 inches was proved to be too little depth, and a pool sloping from zero to the maximum was found to have much useless area, a standard has been reached which has a depth of water around the sides of 16 to 19 inches and a depth in the center of 24 inches.

The playground director thinks that the wading pool should be kept for the use of the small children, and that each playground should be provided with a swimming pool for the larger children, who now make a failure in trying to use the wading pool for swimming. He refers to one in Potomac park in Washington, D. C., as being successful. It is made in two independent divisions which can be used separately or both at the same time, one having 3 feet of water and the other 5 feet as maximum depth. The pools are emptied and cleaned daily and a constant stream is kept running thru them, so that the water is changed constantly during the day.

### Play Instructors

The great problem of the playground is that of instruction. Children, especially in the congested districts, must be taught how to play, and they must have constant and sympathetic supervi-

CINCINNATI'S PLAYGROUNDS.
II. Playground Apparatus in Operation.

sion to keep them within the lines of proper conduct and to improve their mental and moral conditions. There are but few good instructors, and the attempts which have been made to teach the instructors have not yet produced a sufficient supply under the conditions of employment which obtain.

The playgrounds are regularly open but five or six months of the year, and there is nothing to take the time of the instructors during the remainder of the year. The consequence is that their ranks must be recruited almost wholly anew each year from those who are students in schools during the winter or can find winter employment, and are ready to take the brief and rather poorly paid positions during the summer. It is evident that the major part of the instructors are not properly equipped for their work and must be instructed anew each year. The playgrounds director each year recommends a spring school of instruction in which he can give at least a little idea of the problems which will arise and the methods of solving them, the instructors for the summer to be selected from the attendants at this school. There are a few volunteer instructors who can be depended upon for good work, but as a class they are not considered available. The number of trained directors is increasing each year, but fills a very small part of the demand. When indoor play spaces are provided for the winter season and the work can be continued throughout the year, the supply will be more constant and conditions will improve materially.

CINCINNATI'S PLAYGROUNDS.
III. The Apparatus in Sinton Playground in Use at Night.

Making allowance for the 8-hour day, where necessary, the nine playgrounds in Cincinnati in 1912 employed 16 directors and helpers at a total cost of about $4,000 for the season. Counting two directors, two helpers and a caretaker, a playground costs about $75 a week to operate during the season. Directors are paid $70 to $80 a month if men, $50 to $60 if women. Helpers are paid about $10 a month less respectively.

The grounds are not yet old enough to

give definite information regarding cost of repairs. The playground director estimates the repairs on the standard set of apparatus shown in the drawings at $5 to $25 a year according to the care taken of it and the roughness of usage.

### Popularity Produces Large Attendance.

The attendance at the nine playgrounds open during the season of 1912 aggregated 673,131 children. The playground in Inwood park had 155,171 visitors, being in a rather congested residence district, and Woodward park, which is in an outlying district, had 17,252 visitors. In 1911 the attendance was 435,329, but nearly all of the difference between 1911 and 1912 is accounted for by the attendance, 212,863, in the three new playgrounds opened in 1912.

### Local Aids

The mothers in several localities organized clubs to assist the play directors in their work, and by lawn fetes arranged in connection with the Fleischmann free band concerts increased the attendance, aroused public sentiment in favor of parks and playgrounds and raised funds to improve the sanitary and aesthetic conditions of the playgrounds, and in one instance to take the children on an outing to one of the new large parks. Sane Fourth of July celebrations were quite a feature, improving conditions and stimulating patriotic expression.

A daily program of play-activities and recreations was established, which was followed as closely as possible. Discipline was good and the work was conducted with spirit and enthusiasm. The difficulties met were mainly with older children whose wants are not provided for, and they are often guilty of disorderly conduct in the neighborhood. Playground ball games provided for some of the boys were not an entire success, perhaps because they were but a makeshift.

### The People Approve

Cincinnati is proceeding in a very orderly and careful way in the development of its playground system, and as a consequence is gaining the constantly increasing confidence of the people. As the needs of the system are shown the money is provided for filling them, both by votes for bond issues and by private donations, some of which are worth hundreds of thousands. In anticipation of the exhaustion of the million-dollar park fund mentioned, an additional $750,000 has been voted. Many taxpayers made sure that a considerable proportion of the proceeds of these bond issues would be expended for playgrounds before they would vote for them.

The accompanying pictures show playground activities and the apparatus in use. One of the photographs in Plate II shows a part of the standard set in active use, the boys' end.

Plate III shows the use of playground apparatus at night. Wherever lighting and other facilities will permit the apparatus is kept in use in the evening as well as in the daytime.

The photograph at the head of this article shows Hanna Playground, the gift to the Park Board of Miss Mary Hanna. It is bounded by McMicken avenue, Dunlap and Stark streets, and contains one acre. Its equipment is well shown by the photograph, and shows the simplicity and at the same time the adaptability of the equipment. Permanent roofs will ultimately take the place of the tent and awning. The buildings in most of the parks are larger than that seen in this one.

The writer wishes to acknowledge the courtesy and kindness in supplying him with information and photographs and in enabling him to inspect some of the playgrounds of C. H. Meeds, chief engineer of the board of park commissioners; William Hodgkinson, secretary, and N. C. Seuss, director of playgrounds.

# Ornamental Lights of Billings, Mont.

By John N. Edy, Asst. City Engineer.

PRIOR to the 1911 session of the legislature there was no law in Montana covering the creation of special improvement districts for street lighting. Notwithstanding this fact, the city of Billings, thru the efforts of enterprising citizens, had installed 78 5-globe ornamental light posts, distributed thru a portion of the business district.

These lights, privately owned and maintained, proved to be an improvement of such value and attractiveness that the legislature was requested to pass a law providing for the creation of lighting districts. This statute was placed on the books in 1911, as stated, and Montana cities are now enabled to obtain a street lighting system in the same manner that street, sewer, sidewalk and other improvements are secured.

ORNAMENTAL LIGHTING IN BILLINGS, MONT.

Proceeding in accordance with the provisions of the new law, Billings created "Lighting District No. 1," embracing all the territory known as the business district. Included within the boundaries of this district was all that property lighted by the privately-built system of 78 posts. And as the new contract provided for the installation of 116 additional posts, there are now in operation 194 5-globe ornamental lamp posts, replacing the old system of arc lights in the territory served.

The accompanying illustration indicates the effectiveness of the lighting system, while it also gives some idea of the post details and spacing. The post is of cast iron, 13 feet high, and weighs approximately 950 pounds. It sets on a concrete base next the curb and supports 4 40-watt and 1 60-watt electric lamps. All the globes are frosted, which accounts for the perfectly clear light and the lack of blur in the picture. These posts are spaced uniformly 95 feet apart along the streets and avenues, which are 80 feet in width. As the illustration shows, there are two posts at each block corner, each set 75 feet back from the property line; this brings 8 lights at each street intersection. There are 4 posts on each side of a 300-foot block.

The contract price of installation complete was $80.00 per post, the Billings & Eastern Montana Power Co. being the con-

tractor. The maintenance expense, including current and breakage, is $5 per post per month, or a total of $970 for the entire district. Of the total cost of construction and maintenance, the city pays 25 per cent. and the improvement district pays 75 per cent.

### Specifications

The following digest of the specifications is submitted:

*The System*—The system shall be multiple, the voltage 110. Not over 8 amperes to a circuit, nor 4 circuits to a cabinet box.

*The Service*—The service shall be two No. 8 rubber covered double braid wires placed in a suitable conduit leading from a height of 20 feet, in some convenient place located as the city engineer may direct. This conduit shall be laid into a weatherproof steel cabinet box, and made water-proof at its entrance. The wires shall be connected to a 25 ampere combination fuse and switch.

*Circuits*—The circuits shall consist of one duplex No. 10, 500-volt steel lead-covered cable, of approved type, fastened into a 10-ampere plug fuse in a cabinet box and then let out from same in an iron pipe to 24 inches below street or alley grade; except that where pavement or concrete walk exists the depth shall be determined by the city engineer.

After leaving the pipes the cable shall be laid as follows:

In unpaved streets; immediately outside the curb line in an 8-inch trench 24 inches below street grade.

In paved alleys; as near as possible to the building line of the alleys, in an 8-inch trench 24 inches below alley grade.

Across concrete alley crossings; in a trench chiseled in the concrete, two inches deep and wide, and covered when in place with a 1:2 portland cement mortar.

Across paved streets; in a trench chiseled in the concrete base of the pavement.

Parallel to paved streets or avenues; in a trench immediately inside the inside edge of the curb. Where the sidewalk extends to the curb, the trench shall be cut in the walk two inches deep and wide enough to admit the cable, which shall be covered with mortar as specified above. Where the walk does not extend to the curb, either on paved or unpaved streets or avenues, the cable shall be laid in a trench 6 inches wide and 12 inches below curb grade.

At the base of each post to be installed an 18-inch loop shall be left in the cable for the purpose of making connections with the wires in the post.

*Posts*—The posts shall be of cast iron, the weight, form and dimensions identical with those known as the Billings Standard, and shall be erected as set forth on the plan of the district.

The posts shall rest on a concrete foundation 2x2x2 feet, and shall be anchored to the same by means of 4¾x18-inch round anchor bolts embedded in the foundation. The top of the foundation shall be set to sidewalk grade.

The posts shall receive two coats of a mixture of pure linseed oil and lead, colored to match the posts now in place.

*Post Fixtures*—The posts shall be wired with 5 duplex, rubber covered, double braid No. 14 wire, connected to the socket and brought to the base of the post, and there connected with the cable and soldered and taped with rubber and friction.

There shall be 4 40-watt and 1 60-watt tungsten 110-volt lamps; and 4 12-inch and 1 16-inch alabaster globes, to each post. Globes to be firmly fastened with 4 cap-screws and tin collar. The sockets shall be 5 per post, Benco No. 4201, screwed to ⅜-inch nipples 4½ inches long so as to hold the light in the center of the globe.

*Payments*—Payment for work and material will be made on estimates of the city engineer, monthly, in warrants drawn on the funds of "Lighting District No. 1."

# CREOSOTED BLOCK PAVING IN CHICAGO.

By John Ericson, Chief City Engineer, Chicago, Ill.

I RECENTLY made an examination of the method of treating wood paving blocks and the form of specifications under which creosoted block pavements are constructed in Chicago, to determine whether the treatment of the blocks is proper and sufficient.

That portion of our revised specifications referring to the preservative, as well as the manner of treating the blocks, reads as follows:

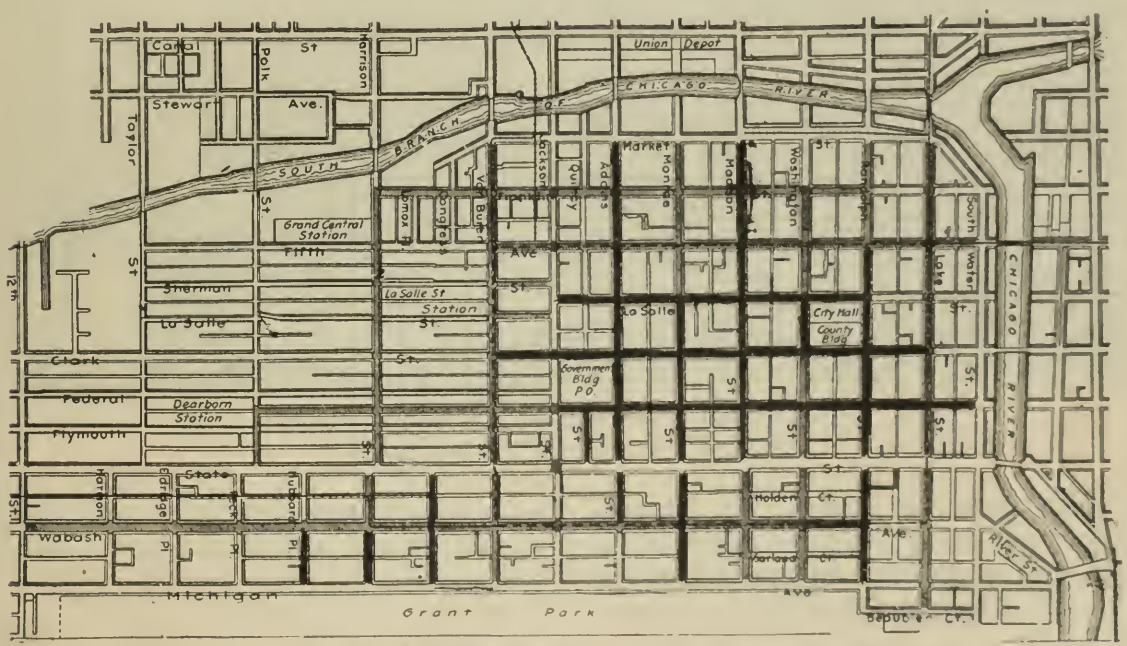
"Oil.—The oil shall be pure coal tar product, free from any adulteration. It must not contain any petroleum oil or any product obtained from petroleum, and shall contain not more than five (5) per cent. of matter insoluble in hot benzol and chloroform. No oil obtained wholly or in part from water gas tar or oil tar will be accepted. The specific gravity of the oil shall not be less than one and ten-hundredths (1.10) or more than one and thirteen-hundredths (1.13) at twenty-five (25) degrees Centigrade."

The present specification for oil in Chicago reads as follows:

"The oil shall be a distillate obtained wholly from coal tar. The specific gravity at 25 degrees C. shall not be less than 1.08 nor more than 1.12."

"The oil shall be subject to a distilling test as follows:

"The apparatus for distilling the creosote must consist of a stoppered glass retort, having a capacity, as nearly as can be obtained, of eight (8) ounces up to the bend of the neck, when the bottom of the retort and the mouth of the off-take are in the same plane. The bulb of the thermometer shall be placed one-half (½) inch above the liquid in the retort at the beginning of the distillation, and this portion must be maintained throughout the operation. The condensing tube shall be attached to the retort by a tight cork joint. The distance between the thermometer and the end of the condensing tube shall be twenty-two (22) inches, and during the process of the distillation the tube may be heated to prevent the congealing of the distillates. The bulb of the retort and at least two (2) inches of the neck must be covered with a shield of heavy asbestos paper during the entire




MAP OF THE BUSINESS DISTRICT OF CHICAGO, SHOWING PRESENT AND PROPOSED WOOD-BLOCK PAVING.

CREOSOTED BLOCK PAVING IN CHICAGO.
Showing Present and Proposed Block Paving in Business District.

process of distillation, so as to prevent heat radiation, and between the bottom of the retort and the flame of the lamp or burner two (2) sheets of wire gauze, each twenty (20) mesh fine and at least six (6) inches square, must be placed. The flame must be protected against air currents.

"The distillation shall be continuous and uniform, the heat being applied gradually. It shall be at a rate of approximately one (1) drop per second, and shall take from thirty (30) to forty (40) minutes after the first drop of distillate passes into the receiving vessel. The distillate shall be collected in weighed bottles and all percentages determined by weight in comparison with dry oil. When one hundred (100) grams of the oil are placed in the retort and subjected to the above test, the amount of distillate should not exceed the following:

Up to 150 degrees Centigrade, 2 per cent.
Up to 210 degrees Centigrade, 10 per cent.
Up to 235 degrees Centigrade, 20 per cent.
Up to 315 degrees Centrigrade, 40 per cent.

These specifications, with a requirement that from 16 to 20 pounds of oil be injected in each cubic foot of wood, have since been in use for creosoted wooden block pavements for Chicago.

### Method of Treating Blocks

I have not visited any plants to determine as to whether the method of treating the blocks is done in conformity with the above specifications, but as the Board of Local Improvements of Chicago have inspectors at the plants where blocks used for pavements in Chicago are treated, it has been accepted as a fact that the specifications have been complied with in this respect.

### Proper Treatment of Blocks

To determine the proper treatment of wooden blocks for paving purposes is a problem not yet satisfactorily solved and which requires careful investigation and experiments.

The principal purpose of treating wooden blocks used for pavements with creosote or other preservatives is to prevent decay of the blocks, and also to prevent swelling or expansion of same by excluding moisture, and for that purpose waterproofing materials are sometimes added to the preservative.

CREOSOTED BLOCK PAVING IN CHICAGO.
Preparing the Sand Cushion Course.

Our knowledge of the effect of the preservatives on the lasting qualities of wood is so far based rather on experience than on any exact scientific principles.

Experience has proved that wood properly treated with creosote—a distilled product of coal tar—will resist decay many years longer than the same wood untreated.

Wooden pavements treated with from five to ten pounds of distilled creosote oil per cubic foot have been in successful operation in England and the continent of Europe for many years; in other words, such treatment has been sufficient to preserve the blocks from decay, and have given little or no trouble from other causes. The exact qualities of kreodone

oil are not known to me, but it is stated to have been a distilled creosote oil, with a small proportion of some heavy waterproofing substance dissolved therein.

I have had prepared a table containing pertinent information in regard to all creosoted block pavements laid in Chicago.

The information contained in this table has been obtained from records of the Board of Local Improvements, from contractors who have kept their pavements in repair under reserve, and from personal observations and investigations made by myself and my assistants.

As stated, wood blocks properly treated with creosote oil will not decay for many years. Whether the heavy tar mixed oil called for as the preservative by the before mentioned specifications will give any better results than the lighter oil previously used is a matter of serious question, and that can be definitely determined only by years of service.

A wood pavement has a certain length of mechanical life, depending on the traffic to which it is exposed. If the blocks are preserved from incipient decay an equal length of time, that seems to be all that could be required.

Communication with Mr. McGarvey Kline, director of the Forest Products Laboratory of the United States Forest Service, at Madison, Wis., was entered into. He and his assistants, Mr. Howard Weis, Mr. Winslow and Mr. Bond, are much interested in this subject.

This is a scientific investigation by experts, actuated simply by a desire to get at the truth. This investigation is now well under way, but will of necessity take some time to complete. I have secured from these experts a specification for the genuine coal tar creosote of high quality, and this specification I have already mentioned.

I have confidence in the value of blocks treated in accordance with this specification, because it is in line with the best experience in wood preservatives, and I have personal knowledge of pavements treated in accordance with a specification quite similar, which have been in use for a number of years, with excellent results.

This does not necessarily mean a condemnation of the heavy oil above referred to for paving purposes. As a matter of fact, the traffic conditions of each street to be paved should be specially considered and specifications prepared that will meet the requirements of each particular case.

CREOSOTED BLOCK PAVING IN CHICAGO.
Laying the Wood Blocks in Place.

From my investigations and inquiries I am of the opinion that pavements laid with block treated under the old forms of specifications or with creosote of a specific gravity of 1.08 or 1.09 are preferable to those treated with the heavy oil later specified, at least for traffic streets in the city of Chicago, where traffic soon makes the blocks impervious to water;

That the "bleeding" is caused principally by the use and excessive quantity of this heavy tar oil in the preservation of the blocks, which is in some cases aggravated by improper provision for expansion;

That this "bleeding" can be largely avoided by the use of the lighter creosote oil as a preservative, and by the proper

selection and manner of placing the filler between the blocks;

That absorption of water and the consequent heaving of the paving can be avoided by laying the blocks in the pavement as soon as they are delivered on the work and by the provision of the proper expansion joints;

That no definite rule as regards the character of oil, manner or treatment, etc., can be adopted for all conditions of streets and traffic, but that different conditions require different treatment;

That if the lighter oils for preserving wood blocks for pavements are eventually found to be preferable to the heavier oils for all conditions, there can and will undoubtedly be an inducement to cause sufficient oil to be manufactured for this purpose at a reasonable price;

That fifteen pounds of oil per cubic foot of wood is generally sufficient to effectively preserve the wood for the length of time of its mechanical life and prevent absorption of water, and that it may be found that much less than fifteen pounds will do. This will vary with the traffic conditions.

Up to November 1, 1911, there had been laid on Chicago streets 439,466 square yards of creosoted wood block pavement and since January 1, 1912, contracts have been awarded for 111,790 square yards, some of which is completed and the balance is now in various stages of construction.

# Concrete Sewer Construction in Louisville.

By J. H. Kimball, Designing Engineer, Commissioners of Sewerage.

THE choice of a material to be used in a structure is a matter of the first importance, involving, as it does, such considerations as strength, endurance and cost.

Several years ago when concrete came into competition with brick masonry for sewer construction, its entire suitability was doubted by many engineers. Some who questioned the strength of concrete did not dare to use it as the sole material in the arch and depend upon it to support the full load over the sewer and, therefore, built a concrete invert with an arch partly or entirely of brick. Other engineers, having more confidence in the strength of concrete, but fearing the action of sewage on concrete, built sewers with a brick invert and concrete arch. As both the concrete invert and concrete arch proved to be satisfactory, concrete came into general use for the construction of the entire sewer barrel.

The Commissioners of Sewerage of Louisville are now completing its $4,000,000 system of sewers. In this system, which is very largely of trunk sewers, concrete has been the principal material used. Vitrified pipe was used in the smaller sizes, but the sewers from 23 in. to 15 ft. 6 in. in diameter were almost without exception built of plain or reinforced concrete. In a few instances vitrified pipe was used as a lining and in some instances vitrified street paving brick was used as a lining in the lower portion of the sewer when, on account of steep grades, very high velocities will be reached by the sewage. Ordinary brick have not been used at all in the construction of these sewers.

### Reasons for Adopting Concrete

The choice of the best material for the sewer masonry was carefully considered previous to the commencement of construction, and the reasons for the adoption of concrete were set forth in the report of the commission for 1909-1910 as follows:

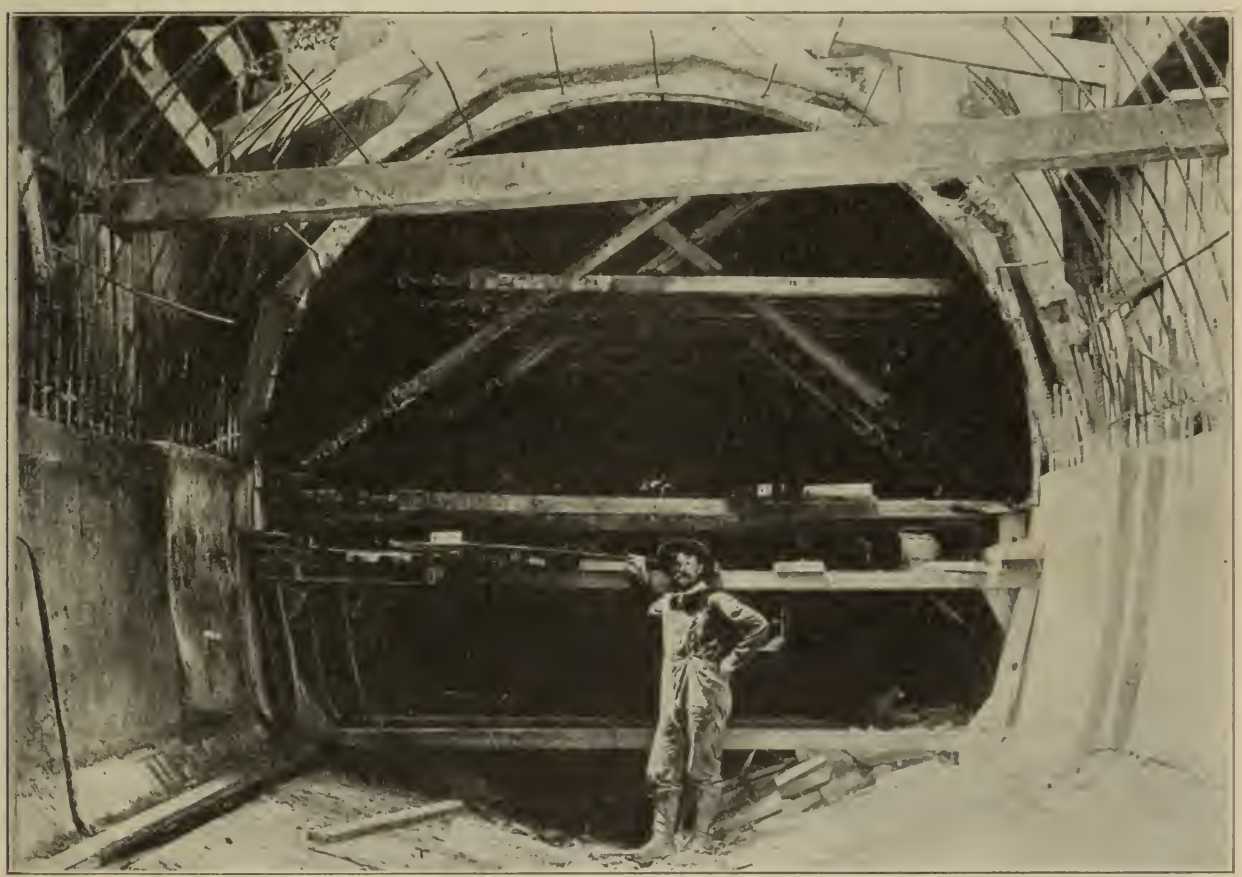
"Very careful consideration has been given to the selection of the kind of masonry to be used in the construction of the sewers and drains. The size of a sewer depends to some extent upon the smoothness of its interior surface and be-

cause of the smooth finish which can be obtained with the use of concrete, this material is particularly favorable for this class of structures. A further argument in favor of the use of concrete is the fact that it is much less expensive per cubic yard than brick or stone masonry. It is also possible because of the practicability of building monolithic structures to vary the thickness of the walls in a way which cannot be done with brick or stone masonry because of the fixed dimensions of the blocks, and thus reduce slightly the thickness where not required and increase it where needed. In this way an additional reduction in expense is effected by reducing the quantity of masonry required per linear foot.

The only serious danger in the use of concrete is that it may be affected by acid in the sewage. Fresh sewage is normally alkaline and practically the only source of acid is the waste liquors from manufacturing establishments. A careful examination was made of the sewage in various sewers about the city and of wastes from many manufacturing establishments. As a result of these investigations it was decided that it was perfectly safe to use concrete in the construction of the sewer system and its use was, therefore, adopted."

### Brick Sewer Larger for Same Capacity

The necessary increase in size of a brick sewer above a concrete sewer, due to its larger degree of roughness, in order to have a sewer of equal capacity, is often as much as 15 per cent. On account of such an increase the cost of both sewer masonry and excavation is necessarily increased, and in crowded streets in which it is often difficult to find sufficient space for an additional structure it is imperative to select the smallest possible size.

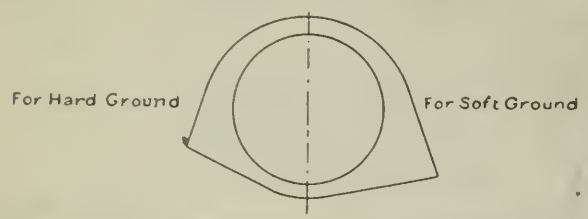


CONCRETE SEWERS IN LOUISVILLE, KY.
Reinforced Concrete Outlet Sewer, Showing Reinforcement and Forms Used in Construction.

### Erosion of Concrete

A very eminent authority stated a number of years ago of concrete, "It is superior to brick masonry in strength, hardness and durability." Concrete sewers after twenty years of wear have shown

no appreciable deterioration. Mr. A. P. Davis, chief engineer of the U. S. Reclamation Service, in an article on the "Safe Velocities of Water on Concrete," has given some very interesting cases of the power of concrete to resist erosion. In two conduits having at times velocities of above 20 and 40 ft. per sec., respectively, no damage to the concrete was perceptible. A culvert thru a dam having a flow of water thru it of a velocity between 75 and 90 ft. per sec. for six months, was "absolutely uninjured" by the water. In the flow over the surface of a dam in which the water reaches a maximum velocity of over 70 ft. per sec., there was no actual damage to the dam but a slight wear was visible evidently due to presence in the water of large quantities of sand flowing over the dam. Mr. Davis, however, speaks of one instance in which a stream flowing in a tunnel at a high velocity was broken up by a change in the cross-section of the tunnel and the presence of four iron gates. Owing to these conditions the stream became turbulent and the resulting impact of the water was




CONCRETE SEWERS IN LOUISVILLE, KY.
Section Showing Modifications for Construction in Hard and Soft Ground.

destructive to the tunnel lining, composed of concrete faced with steel. Mr. Davis concluded from his observations:

1. "That where clear water can be made to glide over concrete without disturbing its velocity or abruptly changing its direction, there is no practical limit to the velocities that can be permitted without harm."

2. "That concrete which is subjected to the impact of water under high velocity is rapidly eroded and that under such conditions the velocities must be carefully limited."

Such tremendous velocities as he cited as having caused damage would be difficult to find in sewer practice.

The wear in sewers is due to the erosion by sharp, hard sand or detritus from street paving. Brick sewers in streets on steep grades paved with trap rock macadam have sometimes shown considerable wear while in others on which the macadam was a comparatively soft limestone no wear was perceptible.

The superior hardness and strength of concrete makes possible a less quantity of masonry.

### Advantages of Concrete in Construction

As concrete is placed in a fluid condition it can be made of any thickness required by strength and may be molded into any form desired, as in the junction of two sewers where the edges between intersecting surfaces form very intricate shapes.

Some of the important advantages of concrete over brick are developed in practical construction. Although skilled labor is required for the construction of brick masonry, every engineer knows the difficulty of obtaining the joints completely filled with mortar. Without this the joint becomes the weakest, whereas it might be the strongest point of the masonry. tI is not uncommon to find brick sewers with an occasional brick fallen out from the arch.

In the construction of circular brick sewers, unless the ground in which the sewer is being built is exceptionally hard, the trench is necessarily dug to an approximately rectangular shaped cross-section, the bottom being nearly flat. As the brick work is laid in the lower half of the sewer the excavated material is replaced in the trench to support the green masonry, and in order not to force the masonry out of place before the mortar has set, the material is placed so lightly that it cannot support the sides of the sewer. Tthe result is that when the weight of the earth is placed on the sewer the structure is ruptured to a greater or less degree. In Louisville the standard shape of the circular sewer is shown herewith in which the weight of the sewer and the backfilling above are borne by the natural undisturbed ground.

### Concrete Sewer Has Less Seepage

Another and oftentimes a very import-

ant advantage in concrete is its comparative water-tightness. Concrete can be made practically impervious by the proper proportions of materials and by properly depositing it in place. For waterproof work a "wet mixture" of concrete should be used. Several waterproofing compounds for concrete are on the market, but for sewer construction it will seldom be necessary to use any more expensive material than hydrated lime or a very fine sand or clay. In Louisville a concrete sewer laid for about 2,500 feet in a water-bearing clay in the bank of a creek was made so water-tight by replacing 10 per cent. of the sand of the concrete by a like amount of fine molding sand that the leakage, if any at all, was insignificant. Brick masonry is water-tight only insofar as the mortar is water-tight and continuous, as ordinary bricks are porous and will allow a considerable amount of seepage through them.

### Economy of Reinforced Concrete

Concrete through its capability of being united with steel may be used with great economy in the larger sizes. Reinforced concrete is particularly useful in sewers with a flat roof or arch. In addition to the advantage of being able to design a section in which tensile strains are expected by the use of steel reinforcement, this material may be utilized to render safer a sewer liable to be subjected to strains that cannot be determined in advance.

In Louisville, it was found that a saving in expense might be obtained in the use of steel reinforcement in all sizes above 5 feet in diameter and in several cases in smaller sizes. In the larger cases the thickness of concrete in the arch and sides was but a little more than one-half that which would have been necessary in an unreinforced structure.

With the exception of one contract in which reinforced pipe was used, all the concrete was monolithic. On this account there were no joints. Steel forms were used in most of the largest sewers, but were not required. On a few contracts wooden forms with metal covering were used. All wooden forms were so finished as to have no irregularities or rough spots, and a very smooth finish was uniformly required. After the sewers had been in use for several months, a thin film of slimy growth developed. This growth is not of sufficient amount to have any appreciable effect on the flow in the sewer.

There have been no failures in the concrete sewers built, although cracks appeared in the masonry on the first sections built on a few of the contracts, due to the use of dry wood forms. These forms, absorbing water from the concrete, swelled, thereby cracking the concrete before it was set. Another source of trouble was found in cases in which trench sheeting was driven below the bottom of the sewer. This sheeting being pulled and the space occupied by it not being completely refilled, small cracks developed on account of the spreading of the sewer. These difficulties were soon discovered and easily corrected.

### Reinforced Concrete Pipe

Invitations were occasionally given the contractor to bid on reinforced concrete pipe. With one exception, the bids on reinforced pipe were always higher than on the monolithic concrete. The specifications required a test loading according to the following table, and also a test for imperviousness.

| Size. | Load'g per Length of 3 ft. | Size. | Load'g per Length of 3 ft. |
|---|---|---|---|
| 24 ins. | 6,000 lbs. | 42 ins. | 10,500 |
| 27 ins. | 6,750 lbs. | 48 ins. | 12,500 |
| 30 ins. | 7,500 lbs. | 54 ins. | 13,500 |
| 33 ins. | 8,250 lbs. | 60 ins. | 15,000 |
| 36 ins. | 9,000 lbs. | 66 ins. | 16,500 |
| 39 ins. | 9,750 lbs. | 72 ins. | 18,000 |

### Relative Economy Is Factor in Choice

The use of concrete may be less economical than the use of brick in localities in which materials for brick manufacture are readily accessible and the materials for concrete are difficult to obtain. In Louisville, concrete was found to be cheaper, and as it was considered much more suitable, its use was adopted. The experience of the commission with this material was uniformly satisfactory so that the conclusion formed previous to the construction seems to have been fully justified.

# Grade and Surface Required on Roads.

THERE are so many variables that enter in to affect the draft of any vehicle, that it is difficult, in a test made under actual working conditions, to separate the effect of any one of them, and for the same reason it is not safe to put too much confidence in the results obtained from a limited number of tests, or to compare the results made by different persons under unlike conditions and at widely varying times.

Some of the variables that are sure to enter in are:

1. The team.
2. The driver.
3. Nature of surface.
4. Condition of the surface.
5. Grade.
6. Width of tire.
7. Diameter of wheel.
8. Design and condition of vehicle.
9. Magnitude of load.
10. Curves.
11. Slopes.

It has been found by the writer and by those with whom he has talked, that in any series of tests it is absolutely essential to select a team of horses or mules that are willing, and that have been trained to steady pulling and even starting, and to retain the same team thruout any series of tests. Furthermore, it is necessary to practice a constant deception on the team in this way; the run should overlap the distance tested by an appreciable amount at each end; that is, the team should be driven several rods past the designated point before any attempt in checking it is made. If this is not done, after the first few trips the team will begin to stop before the point is reached, and the momentum of the vehicle will enter in and will vitiate, to a great extent, the results obtained.

The tests conducted under the supervision of the writer, since 1908, have been run with a traction dynamometer wagon owned conjointly by the U. S. Office of Public Roads and the Engineering Experiment Station of the Kansas State Agricultural College. The dynamometer proper is suspended from the bed of a Studebaker truck about midway between the front and rear axles. The pull is transmitted by the tongue directly to the dynamometer, which pulls on the rear axle. The draft is measured by the compression of two carefully calibrated coil springs, and is transmitted thru gears to a brass point, which marks the record on sensitized paper operated by friction rolls, but over a flat platen.

The following cuts shows the arrangement of the dynamometer and also its method of attachment to the truck. The truck is provided with eight sets of wheels ranging from 1⅝-inch tires up to 6-inch tires.

### Dynamometer Wagon.

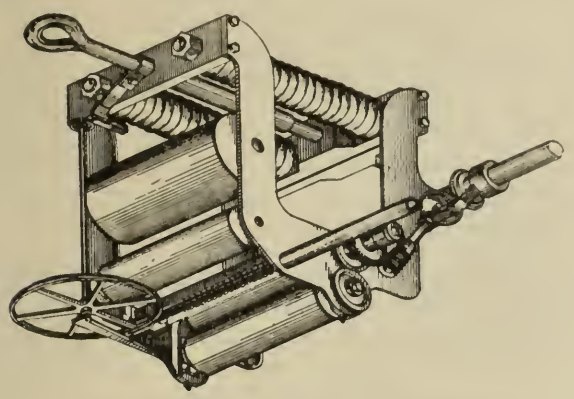
The dynamometer was designed at the college in 1906, and has been in frequent use since that time. It was attached to the truck in 1908, and repeated calibrations have shown that the dynamometer registers very accurately.

GRADE AND SURFACE ON ROADS.
Dynometer Wagon.

While some road materials maintain their characteristics under different conditions, others vary materially with weather and atmospheric changes. Deterioration is much more rapid with some forms of road surface than with others, and some materials, such as dirt, macadam, gravel, etc., are subject to occasional changes in conditions from which the harder materials are free. A pebble

½ inch in diameter may show an increase of 50 to 75 per cent. in the draft required at that particular point; or the wheel may strike it in such a way that no apparent change can be detected.

Of the other variables, some will become constants for any particlar stretch



GRADE AND SURFACE ROADS.
Dynometer Attachment.

of road; others, such as width of tire, may be governed in some instances; while still others, such as design of vehicle, can seldom be taken into consideration.

### Grades.

Increasing the grade decreases the load that can be hauled, in each of three ways:

1. The required pull per ton is increased.

2. The possible pull of the horse is decreased by the effort required for the horse to raise his own weight thru the grade.

3. The effective pull of the horse is diminished by a change in the angle of the application of the pull.

There are no ways of overcoming the first two losses; the third, however, can be nearly if not entirely eliminated by a change in the methods of hitching. A comparison of the figures in the following table will show very clearly the decrease of effective work with the increase of grades. The first column shows the actual pounds of pull required to draw a gross load of 5270 lbs. over a dry, hard earth road, solid and well compacted, no dust, and using 1½-inch tires. These figures are from a test made at the Kansas State Agricultural College on August 12, 1912. The third column gives pounds pull required per ton as figured from values in the second column. The fourth column gives draft in pounds per ton as taken from results of tests on macadam roads. The fifth column shows possible pull of 2800-lb. team on the different grades. These figures assume that a team can exert a pull equal to one-third of its weight for a short time, on the level, and that on grades the tractive effort of the team decreases an amount equal to the grade resistance due to its weight, as calculated by the formula:

$$X = \frac{W}{3} - \frac{W}{100} G$$

Where W = weight of team
X = tractive effort of team
G = per cent. of grade.

TRACTIVE FORCE.

| % Grade. | Dirt Road. 5270 lbs. | Per ton. | Macadam. | Possible pull of 2800-lb. team for a short period of time. |
|---|---|---|---|---|
| 0 | 263 | 100 | 38 | 933 |
| 1 | 315.7 | 120 | 58 | 905 |
| 2 | 368.4 | 140 | 78 | 877 |
| 3 | 421.1 | 160 | ... | 849 |
| 4 | 473.9 | 180 | 118 | 821 |
| 5 | 526.5 | 200 | 138 | 793 |
| 6 | 579.2 | 220 | ... | 765 |
| 7 | 631.9 | 240 | ... | 737 |
| 8 | 684.6 | 260 | ... | 709 |
| 9 | 737.3 | 280 | ... | 681 |
| 10 | 790 | 300 | ... | 653 |

A comparison of these figures will show that the necessary pull on a 10 per cent. grade, over that on a level, is 200 per cent. for a dirt road, while the decrease in effective pull for any given team is nearly 30 per cent., and that for a dirt road any given team can pull on a 10 per cent. grade only 2/9 of the load that it can draw on the level.

In order to get some figures from recent practice, the writer, on September 12, 1912, had observations taken on four teams hauling brick a distance of practically two miles over five different kinds of road surfaces. These teams are used in delivering coal from the railroad to the Kansas State Agricultural College, and are accustomed to hauling heavy loads under all sorts of road conditions. The results obtained from these observations

are undoubtedly larger than can be secured by taking an average of a large number of teams selected at random. In the following tables are given the nature of the road surface, the weights of the loads and the teams, the length, grade, and condition of the road, the apparent effort exerted by the team, the number of rests made, and the theoretical draft that would be required as shown by the draft required for surfaces of that nature. From the draft required for the given load, and the weight of the team, was calculated the probable pull of the team in per cent. of its weight.

CINDER ROAD.

| | Weights. | | No. of | Theoretical draft required. Per | Per | Probable pull of team in % of of its |
|---|---|---|---|---|---|---|
| No. | Load. | Team. | rests. | ton. | load. | weight. |
| 1 | 8770 | 2580 | 1 | 92 | 403.5 | 32.63 |
| 2 | 8440 | 2600 | 1 | | 388.3 | 31.16 |
| 3 | 8160 | 2620 | 1 | | 375.4 | 29.80 |
| 4 | 7090 | 2670 | 1 | | 316.2 | 25.40 |
| Aver.. | 8115 | 2617.5 | | | Aver.. | 29.75 |

Length—500 feet.
Grade—No grade.
Condition—Solid, but dusty in places. Rough where tires cut in.
Apparent effort of team—Heavy pull to start load. Heavy pull to keep load moving.

ASPHALTIC CONCRETE.

| | Weights. | | No. of | Theoretical draft required. Per | Per | Probable pull of team in % of of its |
|---|---|---|---|---|---|---|
| No. | Load. | Team. | rests. | ton. | load. | weight. |
| 1 | 8770 | 2580 | 0 | 40 | 175.4 | 23.80 |
| 2 | 8440 | 2600 | 0 | | 168.8 | 22.70 |
| 3 | 8160 | 2620 | 0 | | 163.2 | 21.80 |
| 4 | 7090 | 2670 | 0 | | 141.6 | 18.60 |
| Aver.. | 8115 | 2617.5 | | | Aver.. | 21.70 |

Length—2760 feet.
Grade—1.5%.
Condition—Very good—in use one year.
Apparent effort of team—Fairly easy.

BRICK PAVEMENT.

| | Weights. | | No. of | Theoretical draft required. Per | Per | Probable pull of team in % of of its |
|---|---|---|---|---|---|---|
| No. | Load. | Team. | rests. | ton. | load. | weight. |
| 1 | 8770 | 2580 | 0 | 56 | 245.5 | 26.50 |
| 2 | 8440 | 2600 | 0 | | 236.3 | 25.40 |
| 3 | 8160 | 2620 | 0 | | 228.5 | 23.90 |
| 4 | 7090 | 2670 | 0 | | 198.3 | 20.70 |
| Aver.. | 8115 | 2617.5 | | | Aver.. | 24.00 |

Length—5000 feet.
Grade—0.5%
Condition—Good—new.
Apparent effort of team—Medium.

DIRT ROAD.

| | Weights. | | No. of | Theoretical draft required. Per | Per | Probable pull of team in % of of its |
|---|---|---|---|---|---|---|
| No. | Load. | Team. | rests. | ton. | load. | weight. |
| 1 | 8770 | 2580 | 1 | 100 | 438.5 | 34.00 |
| 2 | 8440 | 2600 | 1 | | 422 | 32.50 |
| 3 | 8160 | 2620 | 1 | | 408 | 30.60 |
| 4 | 7090 | 2670 | 1 | | 354 | 26.50 |
| Aver.. | 8115 | 2617.5 | | | Aver.. | 30.90 |

Length—1050 feet.
Grade—None.
Condition—Good—well compacted, dry, but not dusty. Surface smooth.
Apparent effort of team—Heavy.

MACADAM ROAD.

| | Weights. | | No. of | Theoretical draft required. Per | Per | Probable pull of team in % of of its |
|---|---|---|---|---|---|---|
| No. | Load. | Team. | rests. | ton. | load. | weight. |
| 1 | 8770 | 2580 | 3 | 150 | 658.8 | 42.50 |
| 2 | 8440 | 2600 | 3 | | 633 | 40.60 |
| 3 | 8160 | 2620 | 3 | | 612 | 38.90 |
| 4 | 7090 | 2670 | .. | | 531 | 33.00 |
| Aver.. | 8115 | 2617.5 | | | Aver.. | 38.75 |

Length—1500 feet.
Grade—5%.
Condition—Solid road; surface good condition.
Apparent effort of team—Heavy pull the entire length.

The results of these observations would indicate that a well-trained team can exert a pull of from 1/5 to ¼ of its weight thru a distance of practically one mile; a pull of from ¼ to slightly over 1/3 of its weight for a distance of 500 feet, and, on macadam, a pull of from 1/3 to nearly ½ of its weight up a 5 per cent. grade for a distance of 500 feet.

Therefore, in considering the permissible grade, in any given case, it is necessary to take into consideration the probable weight of load to be hauled, and the type of horse to be used; then the maximum permissible grade will be that which the team of horses can draw over that grade. This will be determined by figuring the time necessary to travel from the bottom to the top, and the possible force that the team can exert for that length of time.

**Materials.**

The figures given in the description of the effect of surface are taken from tests conducted under the supervision of the writer during the past few years; from those conducted by Professor H. J. Waters at the University of Missoui, some years ago, and from other sources, indiscriminately, when the indications were that sufficient tests had been made to give dependable results. Those conducted by the writer were made, in both dry and wet weather, on dirt roads of various kinds; on gravel, macadam, and oil roads; on vitrified paving brick, and on asphaltic concrete. Those made by Professor Waters include block pavements in good and in poor condition, fair macadam, best macadam, cobble stone, and various types of dirt roads. The other figures are for granite tramways, wood block, asphalt, and macadam.

Deductions drawn from the averages, obtained by combining these different tests, are not strictly accurate, as the tests were conducted under different conditions of driving, vehicle, etc., but as these varying conditions exist in practice, the writer has deemed it of interest to combine the tests and average the results. The following are the figures so obtained:

| Surface. | Tractive force per ton. |
|---|---|
| Earth—packed and dry | 100 |
| Earth—dusty | 106 |
| Earth—muddy | 190 |
| Sand—loose | 320 |
| Gravel—good | 51 |
| Gravel—loose | 147 |
| Cinders—well packed | 92 |
| Oiled road—dry | 61 |
| Oiled road—wet | 108 |
| Macadam—very good | 38 |
| Macadam—average | 46 |
| Sheet asphalt | 38 |
| Asphaltic concrete | 40 |
| Vitrified brick—new | 56 |
| Wood block—good | 33 |
| Wood block—poor | 42 |
| Cobble stone | 54 |
| Granite tramway | 27 |

Incidentally, tests cannot show the force with which a team can grip these different pavements, and, therefore, as will be discussed later, these figures must not be used without taking other variables into consideration.

The effects of temperatures and of moisture are shown very clearly in two tests made at Manhattan, Kansas, in July, 1912, on dry and on wet asphaltic concrete. During the test the atmospheric temperature increased from 82 degrees F. to 98 degrees F. On the dry surface the draft increased 28 per cent.; on the wet 17 per cent. It is very apparent that any consideration of asphaltic concrete for use in any particular place, that does not take account of the probable temperature, will, of necessity, be incomplete.

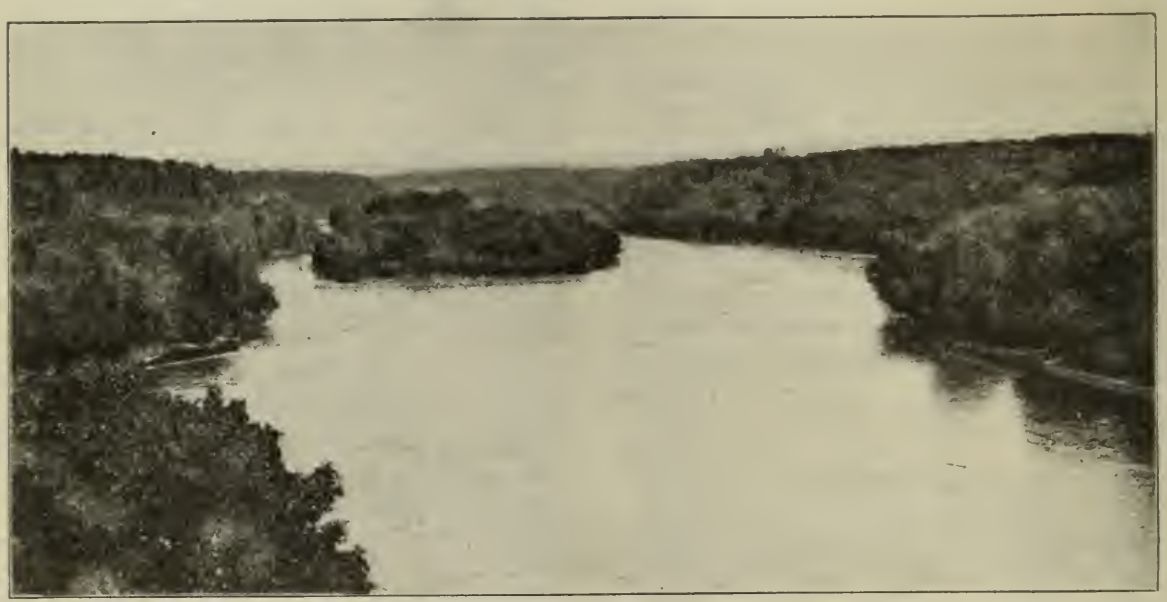
If the tractive force per ton was the only factor that entered in, in determining grades and materials, the solution of the problem would be comparatively simple, as with any given material and with known loads the maximum grade of any given length will of necessity be fixed; but, besides the difference in pulling power that exists among horses, and particularly when combined in teams of two or more, there is also to be taken into consideration the effect of the surface on the grip of the horse. This feature varies with any given substance according to conditions of temperature and moisture, and is not determinable to any degree of accuracy. The question of the relative allowance to be made for this feature is one that must lie with the judgment of the engineer, and the best judgment is that based on the observation of the paving materials under the various conditions.

In the opinion of the writer, the best pavement for steep grades, considering both security of footing and the tractive resistance, is either granite block or vitrified paving block with the spaces between the blocks filled with asphalt or pitch. The softer material in the crevices offers a grip for the calks of the shoe. In the case of cobble stone the effect of the uneven surface, while beneficial to the grip, is to increase the tractive force required, and seriously to increase chance of injury to the horse.

In New York City there are instances of grades of 12.17 per cent., 15.17 per cent., and 18.17 per cent. In Pittsburg grades of 17 per cent.; in Duluth of 12.2 per cent., and in Kansas City of 16.5 per cent.

# THE MINNEAPOLIS PARK SYSTEM.

THE first tract of land dedicated for a public park in Minneapolis was Murphy Square, a little larger than an ordinary city block, given by Edward Murphy in 1857. In 1873 the donor secured an appropriation of $500.00 from the city council for the first tree planting and fencing, and made the improvements at his own expense, as the mayor refused to sign the warrant. In 1882 Hawthorne park, about one acre, was bought for about $13,000.00, nearly one-half contributed by citizens. Franklin Steele Square was donated the same year. The rejection of the project to secure Nicollet Island for a park, thru lack of sufficient votes, is most regrettable, as its acquisition now would be almost prohibitive and the loss seems irreparable.



THE MINNEAPOLIS PARK SYSTEM
Mississippi Park from Government Dock and Dam No. 1.

### Park Commissioners Appointed

In 1883 the board of park commissioners was created, with twelve commissioners, who, with the mayor, the chairman of the committee on public grounds and buildings, and the chairman of the committee on roads and bridges of the city council, constitute the board. It has control also of tree planting on city streets and power to assess the cost on benefited property.

From 1883 to 1906 the board acquired, thru purchase and donations, about 1,800 acres of park land, of which 462 acres were in water area, at a cost of $1,999,550.55, the value of donations being estimated at $457,900.00. The improvements during the same period cost $1,039,199.27.

From 1906 to 1912 the park area has increased thru acquisitions and donations 1,875 acres, and the total area today is 3,685 acres, of which 1,287 acres are water areas. The cost of acquisition in this period has been $2,111,554.34, and the value of donations estimated at $254,050.00. The cost of improvements for these six years has been a little over $600,000.00.

### Cost of Park System

Altogether, the cost of park acquisitions has been $4,111,104.89, and of this amount $2,902,480.30 has been issued in park certificates of indebtedness, payable one-tenth each year from the special tax levied upon benefited property, and the balance paid from bond issues for the payment of land acquisitions, and from the general fund. The total value of land donations is placed at $701,950.00.

The board has secured its land acquisitions at very reasonable prices, and in this connection great credit is due its present capable secretary, Mr. J. A. Ridgway, former commissioner, for his singularly efficient service, both during his term as commissioner and while secretary. The largest part of the land has been acquired during his connection with the board, and unquestionably he has saved the city thousands of dollars in its land transactions.

Improvements to January 1, 1912, have cost $1,643,800.65, and the value of donations and buildings estimated at $68,242.54. The inventory of parks and parkways, based on original cost of lands purchased and improvements made to January 1, 1912, and estimate of value of donated land, makes a grand total of ovtr six and one-half million dollars.

THE MINNEAPOLIS PARK SYSTEM.

II. Bridge No. 1, at Lake Calhoun, 50 feet span, 12 feet head room, 114 feet width, including 28-foot roadway, 36-foot parkway, two car tracks on 12-foot centers and two 10-foot sidewalks. Reinforced concrete to carry two interurban cars, 20 tons per axle, or a 16-ton road roller. William P. Cowles, designer. Cost, $54,000.

### The Park Possessions

A brief description of the park system will tend to give a general idea of the park possessions:

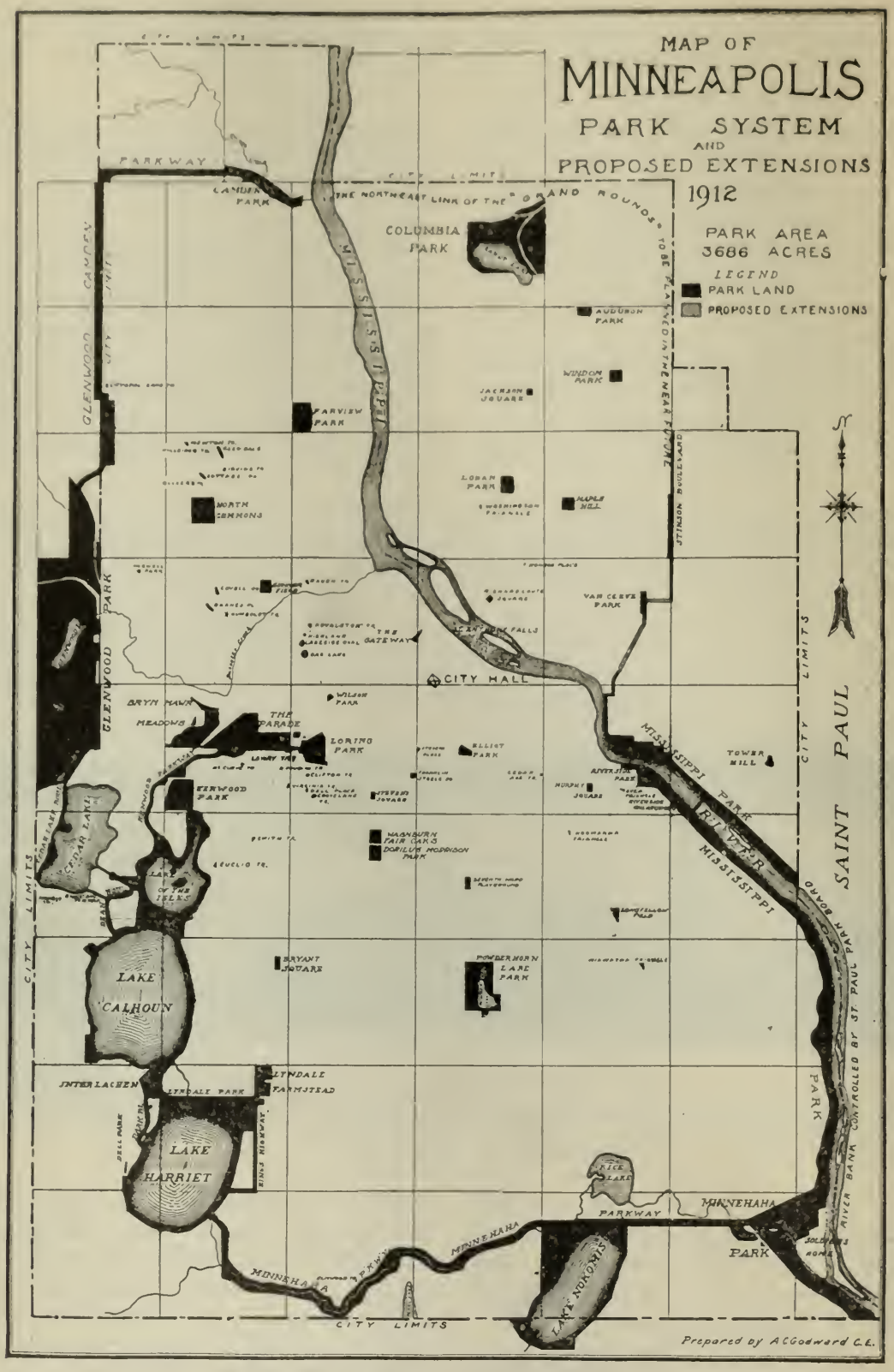
A glance at the city map (Plate I) emphasizes the wisdom and forethought that secured such a comprehensive and well-distributed system of parks and parkways, and a casual study leaves a marked impression of the generous way in which nature endowed the system with lakes, falls, river, creeks, woods, hill and meadow.

Loring park, of 36 acres, was named in honor of Mr. C. M. Loring, known as the "Father of the Minneapolis Park System."

The system of parkways starts at this point, and for a distance of seventeen miles one travels continuously on park lands, connecting many of the principal parks thru varied and beautiful scenery.

Kenwood parkway, starting at Loring park and going west, skirts The Parade, a large open space of sixty-eight acres, ideal for a playground and athletic field, and thru a fine residential district past the wooded and rolling Kenwood park of thirty-three acres, and connects us with the chain of magnificent urban lakes with finely wooded shores and splendid encircling boulevards.

Lake of the Isles, of 107 acres, is the first and rightly called the most picturesque, with its islands and irregular shore line. Next is Lake Calhoun, of 460 acres, the largest of the system, much used for sailing, boating and other water sports, and the location of a splendid bath-house.




THE MINNEAPOLIS PARK SYSTEM.
I. Map Showing Location of Parks and Boulevards.

A little farther south is Lake Harriet, of 353 acres, the favorite recreation spot of park visitors. Free concerts have a great deal to do with the popularity of this resort, as well as spacious picnic grounds, canoeing, boating and fishing.

Minnehaha parkway connects with Lake Harriet boulevard, and in an easterly direction follows the winding course of Minnehaha creek thru natural scenery of hill and dale the whole distance of five and a half miles, past Lake Noko-

mis, of 295 acres, and then bringing us to that romantic spot called Minnehaha park, of 142 acres, and considered by many the gem of the park system. Here we have the celebrated falls immortalized by the poet Longfellow.

From here we follow the course of the Mississippi river along the west bank in a northerly direction. The boulevard is constructed on the bank high above the river, and the land between the drive and the river is rolling, irregular of contour and finely wooded.

For a distance of three and a half miles we travel along the west bank thru attractive natural scenery and get occasional glimpses and again unobstructed views of the Mississippi river and gorge. At Franklin avenue we cross over to the east side, which is also controlled by the park board for a distance of two and one-half miles. The river road east connects with the grounds of the University of Minnesota, and brings us within three miles of our starting point at Loring park.

There are many other parks, large and small, embracing a general plan of large and medium-sized neighborhood parks at convenient distances throughout the city, there being 85 in all, ranging from one acre or less to 584 acres.

The largest and most prominent is Glenwood park, of 584 acres, the great scenic park of the system, and within easy reaching distance. This grand natural park of hill, meadow, woods and lakes will soon be linked with the system of parkways thru connection with the Cedar Lake boulevard from Lake of the Isles. Many of the other parks will be directly connected with the boulevard system as soon as the "Grand Rounds" system is completed.

### Parks Ten Per Cent. of City Area

The following extract, taken from President W. F. Decker's report in the last annual park report, gives an idea of park area in comparison with population:

"Assuming that our present population is 325,000, our park area, exclusive of water, allows 322 square feet, or more than one square rod for each inhabitant.

### Don't Keep Off the Grass

Theodore Wirth, who won country-wide recognition for his work at Hartford, Connecticut, was given the superintendency of the Minneapolis parks January 1, 1906. His capability, initiative, executive ability and enthusiasm have accomplished results.

Perhaps no single action won Mr. Wirth more approval than the order consigning to the dump all the "Keep off the Grass" signs, and the abolishing of fences designed to deny the people the free use of lawns and park territory. It established the principle, "The parks belong to the people."

THE MINNEAPOLIS PARK SYSTEM.
V. Bath House at Lake Calhoun.

### The Modern Improvements

Below are outlined briefly some of the more important improvements completed or started during the past six years, and what is planned for the future:

Probably no other single improvement has been so important and generally ap-

preciated as that of Lake of the Isles, where, primarily thru dredging operations, a complete transformation has taken place. The former swampy and marshy land is now fine lawns enhanced by thrifty tree and shrubbery plantings, and winding walks along the lake shore, as well as fine encircling boulevards, permit the enjoyment of the natural picturesque scenery. Material dredged from the lake has been used for raising the boulevards from one to eleven feet above the old grade, and the shore lines are covered with sand from the same source.

The dredging operations proved a much more difficult piece of work than anticipated on account of the peaty, light and floating character of the greater part of the material handled, and the deceiving, unstable and shifting underlying strata. As the work progressed, many changes to shore lines became necessary and plans and procedure had to be altered to suit new conditions, yet on the whole very gratifying results were obtained.

The dredging was done under contract at 12½ cents per cubic yard, and over 500,000 yards of material were handled, hydraulic and orange-peel dredges being used.

The cost of the improvements has been as follows:

| | |
|---|---|
| For dredging operations covering four years' work | $70,330.01 |
| Grading of grounds, fertilizer, seed and seeding | 30,557.96 |
| Four miles of walks, excavating peat and filling in with gravel | 2,614.64 |
| Filling, grading and rolling of 2.86 miles of roadways | 20,498.90 |
| First oiling of new roadways | 3,383.02 |
| Curbs and sidewalks | 1,694.86 |
| Catch basins and one mile of drains | 4,986.70 |
| Preparation of planting spaces, loam, plants and planting | 8,801.17 |
| Engineering, soundings, inspection, estimates, etc | 5,704.30 |
| Miscellaneous labor, material, etc. | 3,508.04 |
| Total | $152,079.42 |

Cost per acre, $760.40.

One season's work, mainly plantings and cultivation of lawns, will complete the improvement.

The long considered project of a waterway connection between Lake Calhoun, Lake of the Isles and Cedar lake, has been partially carried out. The two former lakes were united last year, and the connection was partly made with the latter.

The dredging of the lagoons and waterways presented no difficulties, but the building of the necessary parkway and railroad bridges proved a large and expensive undertaking. Prizes were offered for competitive bridge designs, and twenty different designs were submitted and selections made therefrom.

Bridge No. 1 (Plate II), the largest, and of a dignified, attractive and very pleasing design, is located at Lake Calhoun. It is of reinforced concrete construction with granite facing, and cost about $54,000.00.

Bridges 3 and 4 span waterways at Lake of the Isles, and are reinforced concrete structures with Bedford stone facings, and cost about $32,000.00 each. They are a credit to the designers and are much admired for their beauty.

Bridge No. 2 is a concrete railroad bridge built in harmony with the other structures and surroundings, and cost about $26,000.00.

Located at Lake Calhoun, on the north shore, is the recently finished, up-to-date and splendidly arranged bath-house (Plate V). It is of a pleasing design, concrete construction, fire-proof throughout, and cost $65,000.00. There are separate departments for men, boys, women and small children, an emergency hospital, shower baths, etc., and a warming room to be used in connection with the skating rink in winter. Pure drinking water is supplied from an artesian well to the sanitary drinking fountains.

In connection with this building the finest inland bathing beach known has been constructed by the pumping of about 100,000 cubic yards of sand out of the lake by hydraulic dredge, at an expense of $16,000.00. The beach is 1,400 feet long and 150 feet wide, gradually sloping out into the lake. At night the beach is illuminated by flaming arc lamps. There are accommodations for

1,300 bathers at one time, and yet it has time and time again been crowded beyond its capacity.

### Playgrounds the Most Useful Feature

Of inestimable value, and the one thing that has more than anything else increased the real usefulness of the parks for the masses, has been the introduction of playgrounds. There are now eight modern, well-equipped and properly supervised playgrounds. Several additional spaces have been purchased and will be improved and equipped next season. In many parks, outside of those mentioned above, play apparatus, such as swings, teeters, merry-go-rounds, sand boxes, etc., have been installed. The apparatus is of substantial, permanent construction and built and installed by the park working force, with the exception of patented fittings, etc. An idea of the various play and recreation features may be had by mentioning a few that come to mind: Twenty-two tennis courts, 22 skating rinks, 4 hockey rinks, 6 baseball diamonds, 7 field or shelter houses, etc. Opportunities for canoeing, sailing, bathing, fishing, ice-boating, boating, skiing, coasting or skating are unsurpassed for unlimited numbers. Equipment of playgrounds has cost, including season of 1911, about $15,000.00, and supervision and maintenance $10,000.00. The attendance last season was about 500,000, and is steadily on the increase from year to year. The playground department is under the direction of a capable and experienced supervisor, and he has a staff of ten instructors.

### Factors in Efficiency of Management.

Below are mentioned some of the things that have contributed, in a general way, to the usefulness and efficiency of the park department:

The discontinuance of privileges and the conducting of the refectories and refreshment stands by the park board under a special department, insuring good service, pure foods and unadulterated drinks at fair prices, any profits being used for general park purposes.

The purchase of a well-drilling outfit and drilling of wells in different parks and squares to secure pure drinking water, especially at playgrounds, picnic groves and neighborhood parks.

The building of permanent machine, carpenter, plumbing, paint and blacksmith workshops.

The organization of a competent engineering department.

The establishing of a special forestry department to look after street tree planting, trimming, etc., and general forestry and planting work in the parks; of a nursery and a greenhouse plant capable of supplying the increasing demand for plants for floral displays. Flower shows are held annually.

MINNEAPOLIS PARK SYSTEM.
THEODORE WIRTH, SUPERINTENDENT.

The reorganization of the park police force with a chief of police in active charge.

The spending of over $10,000.00 per year for free music, and thru the use of a portable band stand on wheels, concerts are now held in nearly all parks of the system.

The oiling of boulevards to lay the dust, which has been found much more satisfactory than sprinkling with water, and cheaper.

The construction, at Lyndale Farmstead, of an administration building containing offices and the superintendent's residence.

# EDITORIAL COMMENT

## PLAYGROUND DEVELOPMENT

The reports of park development which have been received this year give much space to the playgrounds and recreation areas for children and their elders. The idea has been in mind for many years, but has not developed rapidly, partly because no one seemed to know how the grounds should be managed to make them useful and give a moral uplift rather than a tendency toward demoralization.

It is now quite fully recognized that young people from the youngest up need instruction as to how to play, and supervision to keep them out of mischief. The most hopeless looking crowd to be found is one seeking amusement about the city summer gardens, white cities and the like. They wander from one sensation to another without satisfaction, and the search for amusement degenerates into a method of killing time, if it is not worse.

The public play and recreation grounds have been little better, except that sensational apparatus and exhibitions are usually absent, but a new spirit is taking hold and the improvement is already beginning to show. What this results in for the small children is indicated by the results reported in Cincinnati, elsewhere in this number. Kansas City and Minneapolis report similar results in less detail.

The annual report of Secretary H. S. Braucher, of the Playground and Recreation Association of America, shows how widespread is the movement. Thus forty cities report supervised playgrounds opened for the first time this year. The number of cities putting this work in the charge of commissions has increased from twenty-four to thirty-seven. The cities using school houses as recreation centers number forty-eight.

That a definite recreation policy is necessary is shown by the employment of trained recreation secretaries or playground directors. The rather incomplete list in Mr. Braucher's report shows twenty-three cities which have recently or will shortly appoint such supervisors.

## DEMAND FOR PROFESSIONAL MAYORS INCREASING

The city of Arkansas City, Kan., having a population of about 7,500, is seriously considering a form of charter for cities of its size which shall remove the objections to the commission form of city government and retain its advantages. A form of bill prepared by Geo. B. Irving, of Chicago, is under special consideration and contains many valuable provisions. One of

the most valuable is that providing for a competent mayor and the method of securing and appointing him. He is to be appointed by the elected directorate, of five members in the smaller cities, and must fill "so far as possible" the following rather large order: "An expert municipal engineer with knowledge of municipal law, municipal engineering and sanitation, civic landscape, the management of public utilities, for example, street car service, water and light supply, police and fire protection, and such other information upon municipal and sociological subjects, and particularly such questions as concern capital and labor." Not satisfied with this phenomenal character, the bill would make the mayor serve also as the secretary of the local commercial club and he must "have a knowledge of the duties of the industrial secretary which will enable him to perform the functions of such position in a manner to promote the business and aesthetic interests of the city." Arkansas City could pay such a man $4,200 a year, the salary being graduated from $1,800 for a city of 3,000 or less population to $100,000 for one of a million. He can be taken wherever found and contract for four years of service must be made with him.

The provisions of this bill are somewhat more liberal than those in the South Carolina law providing for a municipal business manager, in that the mayor is given more power and is not subject to so much petty interference by the directorate but it is possible that the South Carolina law will work better in practice because it calls for a man of ability, to be sure, but not of such transcendent ability that his like cannot be found.

## RELATION OF COMMERCIAL ORGANIZATIONS TO CITY GOVERNMENT

One provision of Mr. Irving's plan for city government seems to the writer to be based upon a misunderstanding of principles and relations. It is that providing that the city's commercial club shall have its rooms in the city hall and shall have the mayor as secretary. In small cities where everybody knows all that is going on and the amount of business is so small that one man can take care of both offices, economy and efficiency may be promoted by combining the two offices, but the limit is soon reached.

The operation of the machinery of a city, its housekeeping, its public improvements, its bookkeeping, is a very different problem from its promotion and its advertisement. The problems are so very different that they require men of very different temperaments and attainments to attack them successfully.

This close relation of the promotion and the operation of the city is of advantage in securing prompt action upon plans for civic betterment, for the club in its discussions and in its instructions to its secretary is speaking directly to the executive of the city, and the executive can speak directly to the leading men in the city. But he can do this under the present system if he so desires. The mayor, moreover, is under the control of the city directorate, the members of which may stand upon their dignity in case the club issues orders to its secretary which do not conform with the opinions and desires of the directorate as the real employer of the mayor-secretary.

# THE QUESTION DEPARTMENT

## Should Engineer Give Bond for Professional Service

It it professional under any circumstances for an engineer to give or offer to give a surety bond for the faithful discharge of his duties as engineer?

W. Columbus, Miss.

There has been much discussion of this subject, and it has been generally considered that an engineer should not give a surety bond for the discharge of his professional duties. He can, of course, properly give such a bond for the financial part of his work, if he has such. There is, however, an opinion held by a few that an engineer should be willing to give bond covering his professional work, also. The argument on which this is based is, that a man who could secure such a bond would have the confidence of those willing to risk a considerable sum on his competence, and so a more competent engineer would be secured than if the bond were not required. Actually, however, the requirement of a bond is seldom, if ever, made by persons able to judge the qualifications of an engineer, and so the cases in which the question must be considered are almost certainly among the less important. from the engineering point of view, and probably the financial, also. The competition is likely to be, therefore, between the man claiming to be an engineer and the real engineer engaged in this less important work. The latter needs all the protection he can get from the consequences of the ignorance of his prospective employers; and, if he has the confidence of himself and his friends who can back him, the requirement of a bond will be an influence in his favor.

Many city engineers are under bond, but these bonds are not, strictly speaking, bonds as engineers, but bonds as city officials.

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## Blow-Off Valve on Inverted Siphon

I have in mind several locations where I may have to siphon sanitary sewers under streams. In such siphons will blow off valves be advisable or will thorough flushing of the system once a day remove any tendency to clog the siphons.

S. E. ———, Okla.

A blow-off valve in an inverted siphon is excellent, if one can be put in, but that means enough fall in the stream to allow it to discharge without the water in the stream backing into the sewer. It may be found that as frequent flushing as once a day is not necessary. The pipe through the siphon should be smaller than the general size of the sewer, so as to keep up as nearly a maximum velocity as possible. Manholes should be put in at both ends, so that the pipe can be cleaned by hand when necessary. Unless flushing is very copious, the changes in direction and velocity of flow will be such as greatly to reduce the efficiency of the extra flush in removing deposits. One of the new forms of sewer cleaner could be used here to advantage, as they loosen and stir up the solid matters so that they can be carried away by the flushing stream. The reduction in velocity in the manhole or pipe in which the sewage arises from the inverted siphon to the outlet sewer will still make hand cleaning of that manhole or pipe necessary.

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## Filling Water Pipe Trenches in Macadam Road

We are building some state roads through this town and the water company's pipe line will come underneath them in some places. When the line was put in it was not properly calked and we frequently have leaky joints We have dug up several under this road which is not yet completed, and they have requested us to fill the hole with stone and they have completed it with their other work. What will be the best way of fixing these leaks after they are gone?

The company, of course, will have no twenty-ton roller to finish it with. In other words how is it done in other places?

L. Supt. Water Works ———, N. Y.

The trenches or holes dug in the roads hereafter can be filled satisfactorily with stone, if as much fine material as is necessary to fill the voids in the stone is used and the material is tamped or flushed with water as the fill is made, according to the nature of the surrounding soil. Flushing with water will not be good if the soil is clay or other impervious material. By carefully filling and tamping, the road can be brought up to

a good surface, which will settle but little, if any.

## Ordinance Establishing City Purchasing Agent

We wish an ordinance to cover the scope of a purchasing agent's business.

CITY ATTORNEY.

Can our readers send us copies of such ordinances?

The purchasing agent is usually an employe of the board of public works, the comptroller or the mayor, and in such case the ordinance would be very simple, details being left to the head of the department.

Staunton, Va., has a business manager, and the ordinance governing him would doubtless be of service to our correspondent. A copy of it would doubtless be sent by the city attorney or by C. A. Ashburner, the business manager.

## Ordinances Governing Poles and Wires

I will be glad to have you give specimen of ordinance granting franchises to corporations to erect poles and stretch wires along and upon the streets of the municipality.

F., City Attorney, ———, Ga.

A very simple ordinance reads as follows:

1. Give routes of the lines of wires for which permission is granted.

2. In case said city shall be sued for any damage done to any person or property in said city by the erection of its said poles and wires, or the subsequent maintenance thereof, it shall appear and defend the same; and should said city be held liable for any damages so sustained, said company shall be liable to said city for all sums paid by her on account thereof, with 8 per cent. interest thereon, and said judgment against said city shall be conclusive against said company.

3. In case said company or its successors or assigns, shall at any time merge or consolidate the same with any other telegraph company or lease to or otherwise turn over its said line of telegraph to said company then, and in that event, the rights hereby granted shall be null and void, and the poles and wires of said company may be removed from the streets and alleys of said city. The council hereby reserves the right to impose a tax or charge of not less than $2 nor more than $5 per annum on each and every pole of said company erected on the streets and alleys of said city for the privilege it enjoys in maintaining its poles thereon.

4. No pole shall be erected upon any street or alley hereinbefore named at any point which does not meet with the approval of the city civil engineer of said city; and the council hereby reserves the right to require said company to remove its said poles from one point to another on said streets and alleys whenever, in their judgment, the public interests demand such removals.

5. Said company shall place guards around all excavations made by it when laborers are not at work at such points, and shall fill up all such excavations in two days from date of notice so to do by the street commissioner or other agent of said city.

6. Said company shall observe and comply with the provisions of all ordinances of said city, and in default thereof this ordinance may be repealed at any time, and when so repealed all rights hereunder shall immediately cease.

This ordinance lacks one provision, as the city in which it is in force found when it attempted to place the wires underground in certain parts of the city. A provision giving the city the right to order wires underground should be included.

As a city grows the necessity for closer control of wires, poles and conduits becomes evident, and the contracts with telegraph, telephone, light, power, and other companies become more complicated and it becomes necessary to make contracts or ordinances for each class of companies and uses of wire.

## Determination of Burnt Asphalt

I have not seen any statement showing how it may be determined in a ready way, whether in distilling the volatile portions of natural oils, the asphaltum that is used in road construction has been burnt. If you can advise me how this may be readily determined, so that burnt asphalt may not be allowed in street construction I will appreciate your action very much.

I think that at least some of the cases where there have been unsatisfactory results obtained in using oil asphalts, the failure can be attributed to what might be termed destructive distillation.

T., Tampa, Fla.

Discussions which will throw light on this problem will be found in articles on "Control and Onwnership of Asphalt Pavements" in MUNICIPAL ENGINEERING, vol. xxxvii, p. 301, and "The Value of the Carbene Requirement in Asphalt Specifications," vol. xxxv, p. 349.

The proportions of free carbon and of the hydro-carbons are changed by the coking of the asphalt, so that the effect of over-heating the asphalt is readily seen, if not by direct examination of the product, certainly by simple chemical determinations.

Will our readers suggest methods which they supply to their inspectors for determining this fact?

## Methods of Testing Asphalt and Coal Tar

Would you kindly tell me where I can find the standard methods of testing asphalt, asphaltic cements and coal tar products?
STATE HIGHWAY CHEMIST.

MUNICIPAL ENGINEERING numbers for May and August, 1911, vol. xl, pp. 417, 437, and vol. xli, p. 342, contain the specications desired. The proceedings of the American Society for Testing Materials, Edward Marburg, secretary, University of Pennsylvania, Philadelphia, contain the standard methods and descriptions of the standard apparatus.

## Articles on Electric Conduits

Have you published anything on the subject of underground systems of electric wire conduits in recent numbers?
E. M. H., Burlington, Vt.

Following are valuable articles in recent numbers of MUNICIPAL ENGINEERING:

"Electric Wire Conduits at Westfield, Mass.," vol. xlii, p. 220.

"Underground Electric Distribution," vol. xlii, p. 362.

"Conduits of the Lincoln Park Electrical System," vol. xl, p. 443.

References to some new systems and sources of information about them are given in vol. xlii, p. 306.

## Permission to Lay Pipe in Private Street

Do you know of a special form of application for water for consumer (property owner) to sign for water service, the granting of the application making it necessary for the water company to lay water mains through the streets of private property, that is, a development whose streets have not yet been turned over to the town or county. In order for a company to lay mains in such streets it would be necessary for them to have a release from the property owners for an easement in such streets, which would give the water company the full right to lay and maintain water mains indefinitely. In your special service department if you have any data respecting this subject I would be glad to hear from you.
E. M. L., New York.

Those who lay out plats such as that described and those who purchase lots therein are generally very anxious to have water and gas mains laid in the streets, because of the material enhancement of the value of the property. If, however, lots have been sold including therein ownership of the streets and the streets have not been legally dedicated or have not become public by reason of use by the public, it might be possible for objecting property owners to make much trouble if not entirely to prevent laying of such mains in the street through their property to reach property beyond, although the pipes are to be laid in the street. The character of the right-of-way in the street, granted by the plat from which the lots are sold, would have much influence in this decision. Possibly the law of eminent domain could be invoked. The question is one for an attorney versed in the laws and court decisions in the State and who can ascertain the exact legal conditions surrounding the particular case.

Have our readers any cases in mind which would aid our correspondent?

## Best Material for Water Supply Line.

I need about 1,000 feet of 10-inch tile to run up through a swamp and tap an artesian well about twenty feet below the surface. This is the height to which the water comes in a strong flow, about seventy-five miners inches. I have here clay in abundance, sand and lime rock which could be burned. Cement is quite high and especially so as my funds are about exhausted. Now what is the cheapest possible way that pipe can be made here and how? The clay when molded by hand in common hand made molds takes a long time to dry enough so it can be taken out of the molds and then it cracks. How can I utilize it? Will they have to be burned?
H. G. ———, Chihuahua, Mex.

As it would take not more than twenty barrels to make the amount of pipe required, and limestone is at hand to be broken up to the required size of particles for aggregate at low cost for labor, it would seem from this distance that the cement pipe would be much the cheapest. The dried clay pipe would not serve, and the cost of providing kilns and burning the tile would far exceed that of cement, especially for so small a quantity. Possibly the clay is not suitable for making pipe strong enough for the depth of fill stated, and this should be determined if the use of the clay pipe is seriously considered.

Why not use bored logs if the earth about the line of pipe is always saturated with water, and timber is available?

Have our readers any suggestions to offer?

## Ordinances Governing Automobiles in Cities

We are trying to frame a new automibile and vehicle ordinance and would like to know what others are doing.
H., City Attorney, ———, Vt.

Ordinances covering various parts of the field will be found in MUNICIPAL ENGINEERING, vol. xliii, pp. 38 and 388. These are simple but comprehensive. The Cincinnati vehicle ordinance is perhaps as inclusive and elaborate as any which has been put in force.

# FROM WORKERS IN THE FIELD

## Creosoted Wood Block in Atlanta, Ga.

The Editor of MUNICIPAL ENGINEERING:

Sir—Since 1897 we have, in the city of Atlanta, laid 121,011 square yards of creosoted wood block paving at a total cost of $327,702,88, or at an average of $2.55 per square yard. These streets, totaling 25,446 linear feet, carry our heaviest traffic and are in excellent condition, and have been maintained at practically no expense.

Our creosoted wood blocks are of southern long-leaf yellow pine, 90 per cent. heart, 3 to 3½ inches in depth, 3 inches in width and from 6 to 8 inches in length, with the fiber of the wood running in the direction of the depth.

Shorter blocks than those above specified are only used in the starting of courses or in making of closures. Twenty pounds of creosote per cubic foot of wood is required.

We are more particular than most cities in seeing to it that the three courses, laid next to and parallel with the curb, are strictly parallel from a mathematical viewpoint, and that the blocks are driven tightly together.

Our expansion joints are filled with No. 6 coal tar paving pitch, pouring at a temperature of 300 degrees F., and our close inspection guarantees it to be a durable and adhesive filler. We use a clean sand cushion one-half an inch in depth. Perfectly uniform surfaces are required.

Creosoted wood block paving is used so extensively in our business district, not only on account of its durability under heavy traffic conditions and low cost of maintenance, but on account of its noiselessness. The question of noise in the business district of our large cities is becoming a serious matter. Creosoted wood block paving has certainly done its share in doing away with the roar and din of traffic.

BROAD STREET, ATLANTA, GA., LOOKING NORTH INTO PEACH TREE STREET. PAVEMENT LAID IN 1908.

We keep our streets washed by means of high pressure flushing machines, and we find creosoted wood very easy to clean. It does not pulverize, wear away and grind into dust. The absolute smoothness makes sweeping and cleaning an easy matter, and it does not require frequent sprinkling. Its evenness of wear is also an important matter when it comes to the question of street cleaning at a minimum expense. Its freedom from dust and mud is appreciated by our street-cleaning bureau.

Any pavement to be thoroughly satisfactory must also be sanitary, and I consider wood block very satisfactory in this respect because the blocks do not absorb

street filth, the joints are not open for the absorption of refuse matter, and the creosote treatment destroys germs.

Durability is one of the prime requisites of a street pavement. Once a street is paved it is always to be a paved street. If the pavement is not durable the time will soon come when a new pavement must be paid for. The only test for durability is long and efficient service at the smallest average annual cost for upkeep and maintenance.

R. M. CLAYTON,
Chief of Construction, Atlanta, Ga.

## Boulevard Pavement Must Stand Traffic

The Editor of MUNICIPAL ENGINEERING:

Sir—The automobile is the vehicle we must reckon with in these days, and in the laying of asphalt park drives and boulevards we look upon each job as an engineering proposition. In every instance great care is taken that the wearing surface be composed of such constituents, properly graded, as will conform to traffic conditions. On the boulevards of our park system the surface mixture is so kneaded and compressed by heavy traffic as to afford a greater resistance to the deleterious effect of moisture and the chemical action of the air than on light traffic drives, where such kneading process is lacking; consequently, less bitumen and oils are required on main thoroughfares and a harder pavement may be laid. In order to withstand atmospheric conditions successfully, a softer pavement is necessary on light traffic drives, and contains a larger proportion of oils and bitumen, which gives a high penetration.

In the West Park System we have laid many miles of Cuban natural asphalt concrete pavement with great success, and I might add that the amount of traffic in the West Chicago Park System is an excellent test for any kind of pavement.

Our drives show little disintegration and have a fine granular surface, which insures a good footing for either automobile or horse. These streets retain their contour, showing no movement during hot months, nor do they become brittle during the cold months. Our binder is laid at a temperature of about 250 to 300 degrees F., and consequently does not chill through contact with the cool concrete base before it can be properly raked and compressed. We operate our own Twentieth Century portable asphalt paving plant, and consequently have few delays. Raw materials can be hauled more economically than the prepared mixture, as regularity and speed of delivery are of less importance. Batches of prepared material can be more advantageously delivered on the street, and more evenly and economically spread in place in small quantities wheeled in carts or barrows than in large loads brought in wagons.

The following tables compiled by the West Chicago Park Commissioners give the total number of vehicles passing a given point as shown below for a period of twenty-four hours on the dates given:

ON BOULEVARDS.

*Ashland, at Jackson.*

Sunday, Sept. 17.

| | Autos. | Horses. | Cycles. |
|---|---|---|---|
| 7 a. m. to 3 p. m.. | 1,206 | 188 | 394 |
| 3 p. m. to 11 p. m.. | 1,601 | 177 | 385 |
| 11 p. m. to 7 a. m.. | 320 | 40 | 68 |
| Totals ..... | 3,127 | 405 | 847 |
| Total for day..... | | | 4.379 |

*Washington, at Forty-fourth Avenue.*

Monday, Sept. 18.

| | | | |
|---|---|---|---|
| 7 a. m. to 3 p. m.. | 1,885 | 251 | 521 |
| 3 p. m. to 11 p. m.. | 3,180 | 389 | 498 |
| 11 p. m. to 7 a. m.. | 308 | 43 | 76 |
| Totals ..... | 5,373 | 683 | 1,095 |
| Total for day..... | | | 7,151 |

*Jackson, at Halstead.*

Sunday, Sept. 10.

| | | | |
|---|---|---|---|
| 7 a. m. to 3 p. m.. | 2,135 | 414 | 376 |
| 3 p. m. to 11 p. m.. | 2,240 | 220 | 345 |
| 11 p. m. to 7 a. m.. | 518 | 125 | 122 |
| Totals ..... | 4,893 | 759 | 843 |
| Total for day..... | | | 6,495 |

*Oakley, at Jackson.*

Thursday, Sept. 14.

| | | | |
|---|---|---|---|
| 7 a. m. to 3 p. m.. | 306 | 123 | 248 |
| 3 p. m. to 11 p. m.. | 480 | 175 | 264 |
| 11 p. m. to 7 a. m.. | 85 | 35 | 17 |
| Totals ..... | 871 | 333 | 529 |
| Total for day..... | | | 1,733 |

*Sacramento, at Jackson.*

Monday, Sept. 11.

| | | | |
|---|---|---|---|
| 7 a. m. to 3 p. m.. | 280 | 125 | 134 |
| 3 p. m. to 11 p. m.. | 400 | 107 | 217 |
| 11 p. m. to 7 a. m.. | 85 | 28 | 55 |
| Totals ..... | 765 | 260 | 406 |
| Total for day..... | | | 1,431 |

The laying of our asphaltic-concrete pavements, with our own plants and employes, has been exceedingly successful. During 1911 the area paved was 137,559 sq. yds. at a cost of $84,236.02, reducing this cost to 61¼ cents per square yard. This is a reduction of a little more than 6 cents per square yard as compared with 1910.

F. J. GREEN,
Superintendent of Paving,
West Park System, Chicago, Ill.

## Ornamental Lighting in Waterloo

There is no defect in the general make-up of a city that so detracts from its appearance as poorly lighted streets. On the other hand, there is no improvement that so adds to the general aspect as a well-equipped system of illuminating thoroughfares, especially those of the business districts.

The transformation of the down-town district of Waterloo from a commonplace business center to a site of beauty and brilliance has been one of the greatest moves ever made in Waterloo.

The first step was that of lighting the Fifth-street bridge. Turning on the light in this locality had a stimulating and moralizing effect. It is no longer a lounging or loafing place, and is now regarded as a safe crossing for even the most timid pedestrian.

Following the installation on the bridge the enterprising merchants between Sycamore and Lafayette streets took the initiative and installed the system. After the lighting of one block on Fifth street came an extension up Sycamore one block to Fourth, up Lafayette one block from Fourth to Park avenue.

The benefited property owners pay the cost of installation. The city then assumes the maintenance and current expense. The initial cost is about $1.25 per running foot to the merchants installing where there are four lights to the block.

Ordinance No. 704, which fixes the standard for ornamental lighting posts and fixtures, provides in part as follows:

"The post or standard shall be 13 feet and 6 inches from the curb to the center of the top globe, and shall provide for four side and one top vertical upturn lights. It shall be equipped with roughed inside ball globes. The four side globes to be 12 inches in diameter and the top globe 16 inches in diameter. The total estimated weight of the post and fixtures shall be 1,000 pounds.

"Be it further ordained that the owners of property abutting on any street to be lighted with boulevard lights shall purchase and install said posts and equip them with lights.

"Be it further ordained that upon installation of boulevard or street lighting posts upon any street, said posts shall be placed ninety (90) feet apart, four posts on each side of each block, the posts nearest the corner to be located fifteen (15) feet from the outside property line of the corner lot.

"Be it further ordained, upon the installation of street lights, posts and fixtures in compliance with the standard and regulation above provided. the city of Waterloo shall have complete control and regulation of the said boulevard lights, and shall designate the hours during which said lights shall be illuminated.

"Be it further ordained, that if the owner of any property abutting on any street in the city of Waterloo shall install or attempt to install any street lighting posts and fixtures which do not comply with the specifications of the standard post and fixtures herein described, he shall be guilty of a misdemeanor and fined not less than ten dollars ($10) nor more than fifty dollars ($50)."

Ordinance No. 2617 establishes a boulevard lighting district under conditions provided in ordinance No. 704.

Ordinance No. 2711 designates the watt power. Where there are five ornamental lighting poles to either side of a block, the four side lights are 40-watt and the top light 60-watt.

We consider the arrangement whereby the property owner pays for the cost of the ornamental post complete, including installation, and the city assuming the expense of maintenance and current, as being ideal in every respect.

One hundred and sixty-eight ornamental posts are already installed, and further installations will continue to be made until the work of properly lighting the entire boulevard district is completed.

We have now in operation, including the Fifth-street bridge, 185 ornamental standards. The top lamps burn on an average of 3,850 hours per year and the lower four lamps 1,540 per year.

185 posts at full candle power, 1,540 hours, 62,678 k. w. per year.

185 posts at 60 watts, 2,310 hours, 25,641 k. w. per year.

Total. 88,319 k. w. per year.

88,319 k. w. at 5½ cents, $4,857, total cost for electricity consumed in 185 posts.

Average cost for renewals and breakage of lamps and globes per post is $3.25 per year.

Number of lamps installed: 1910, 32 posts; 1911, 104 posts; 1912, 32 posts; total, 168 posts. This does not include posts on bridge.

We have been put to very little expense on account of breakage of globes, and the cost of maintenance and current is slight.

There was considerable speculation as to the additional cost entailed on the city's light fund by the installation of the boulevard lights. An investigation of the itemized expense account of the light fund reveals that very little increase is noticeable. The average cost per block per month of the cluster lights is $25. The lowest amount paid for any one block in a month was $18.32 for the block on Lafayette street between Park avenue and East Fourth street. The block on Jefferson street between West Fifth and Sixth streets cost the city $38.17 during

the month of November. Variations in the monthly cost of cluster lights are caused by failure of the night officer detailed to extinguish the lamps.

The ornamental lighting standards, as used, are of a proper mixture of strong pig iron and steel, and are made by the Waterloo Malleable Iron Works. The wiring is easily accessible, yet protected from injury by any cause. The lamp bowls on the arms are interchangeable with the ornaments, and their position may be reversed if at any time it is desired to hang lamps below the arms. The globes are arranged so as to give proper diffusion of light on the show windows, walks and streets. The height of the globes is sufficient so that pedestrians will not be inconvenienced by the glare in their eyes, and yet not so high as not to properly illuminate the street. Lower standards and less powerful lights would mean more standards and more current. The globes are upturned in order that they radiate over a large area, as down-hanging globes concentrate the light in circular spaces.

Charles A. Roby,
City Engineer, Waterloo, Iowa.

accumulated in their sewers from a depth of three to fifteen inches.

We pay careful attention to our sewers in this city. We keep all decomposed matter and roots out by means of turbine machines. We keep the pipes as free and as open as when first laid. Our machines clean and scour sewers, from eight to thirty inches, at a cost of from three to seven cents per lineal foot. The first sewers which we cleaned were 8-inch, and they were in an exceedingly filthy condition. The cost per foot for the first three blocks cleaned was 3.28 cents per foot.

The city of Winnipeg, Canada, spends $30,000 a year to deodorize its sewers. In a great many cities there is a fungus growth on the walls of the pipe, and by the use of the machine this is all eliminated, as it revolves around on the inside of the pipe with about the same velocity as an electric fan, picking up the sand and whirling it around. We also disinfect the sewer at the same time, or it can be done after the cleaning process.

G. M. Downing,
Commissioner of Streets and Public Property, Tulsa, Okla.

WASHING ASPHALT PAVEMENTS AT WINNIPEG.

## Keep the Sewers Clean

The Editor of Municipal Engineering:

Sir—It is almost as detrimental to the public health to have from a two to six-inch accumulation in sewers as to have a complete stoppage. An unclean, partly choked-up sewer is a deadly menace. It is a breeding place for health-destroying germs.

Merely flushing a sewer is not sufficient, as it merely pushes most of the mass but a short distance from the manhole. Sewers must be thoroughly cleaned and then kept in a cleanly condition.

We hear a great deal about bad garbage conditions, impure milk, expectorating in cars and on streets, and fly-swatting, but most municipalities are altogether too apt to overlook the decomposed organic and vegetable matter which has

## Washing Winnipeg Streets

The Editor of Municipal Engineering:

Sir—While portions of certain streets are allotted to the "white wing" with his scraper and broom, we sprinkle, wash and scrub our eighty miles of asphalt, as well as other smooth pavements, with the squeegee machine.

In the winter time we keep the sidewalks cleared of snow by means of horse-drawn snow plows. We have in the neighborhood of five hundred miles of walks within our city limits, but, owing to climatic conditions, we find it better to leave a few inches of snow on top of the walks.

At night we flush a certain number of streets direct from the hydrant, using a 1½-inch hose. We did use 2½-inch hose, but found it too heavy to handle; the

1½-inch does the work just as satisfactorily. To my mind there is only one way to clean asphalt, and that is by washing it.

While our water works system is owned by the city, the supply being from an artesian source, there is such a thing as using too much water for street purposes, and for this reason the use of our street-washing machines is eminently satisfactory, because the consumption of water is extremely small for the results obtained.

We line our squeegee machines across the street as shown in the accompanying illustration, and they clean the street from gutter to gutter. The dirt is left in a long windrow along the gutter, where it is gathered up and taken away in carts. the machines do not use enough water to wash the dirt into and thus clog the sewers. The pavements are dry a few minutes after the machines have passed.

W. F. Tallman,
Street Commissioner, Winnipeg, Man.

## Municipal Publicity

The Editor of Municipal Engineering:

Sir—Your request for an article regarding what you term my short paragraph sermons is at hand, and I will endeavor briefly to illustrate what I am trying to accomplish.

The experience of several years has shown me that "statistics" should not be put before the people frequently in the shape of a great mass of figures, which at a glance is appalling, but rather in a concise manner easily understood by the average person. How to accomplish this has been a constant study with me.

A short time ago one of our daily newspapers, which has always courteously published whatever figures this office has furnished, solicited material for a number of articles pertinent to municipal activities. Desiring to make these articles short and interesting at the same time, I prepared a number of paragraphs which have been published on the front page of the paper referred to. Some of these articles were also printed in the October 31st issue of *Municipal Statistics.*

The subject-matter, where possible, is shown in a comparative way, being brought to the readers' notice more in the light of a story, and impresses itself on the memory more readily. For instance, the citizens of Minneapolis know that we have an extensive park system comprising about 3,600 acres, but how many realize that this area would accommodate at one time a huge picnic party embracing the entire combined population of Minneapolis, St. Paul, Duluth and Superior, and there would be an average space for each person equal to a room 15x 15 feet; that the entire mileage of sewers in the city, if placed in a single line, would extend from Minneapolis to Milwaukee; that the mileage of pavements, average 27-ft. roadway, is equal to a highway extending from Minneapolis to Ashland, Wis.; that the mileage of stone sidewalk is sufficient to line both sides of a highway extending from Minneapolis to Chicago; that the mileage of lighted streets in the city, 60 per cent. being electric lighted, would make a continuous lighted thoroughfare from Minneapolis to Kansas City?

These are perhaps homely and simple comparisons, but, judging from the numerous favorable comments which we are receiving regarding them, I am of the opinion that the magnitude of the various items is better understood when comparisons are shown. Take for example the daily output of the twenty-three flour mills of Minneapolis, amounting to 71,200 barrels, which, though immense, does not particularly impress one, but when we say that these barrels rolled along the street at the rate of one per second would require twenty hours to pass a given point, or placed end to end would extend a distance of thirty-two miles, or would present a frontage of 1,000 ft. long by 220 ft. high if piled along the side of the street, ends to the front, then one begins to realize the greatness of this daily production of flour.

I have also in preparation paragraphs showing the rank of each of the thirteen wards relative to area, population, amount of taxes paid, etc., illustrated as follows: The Second ward ranks fifth in area with 2,759 acres, tenth in population with 19,000, fifth in assessed valuation, pays 7 per cent. of the total taxes. Property in the ward is utilized for manufacturing, linseed mills, grain elevators, railroad trackage, State University, residence and retail, importance being indicated in the order named.

This is an outline of the policy I am pursuing in presenting statistics in a manner which I hope will the better enable the taxpayers of Minneapolis to know their city and its municipal activities.

H. A. Stuart,
City Statistician, Minneapolis, Minn.

## Advantages of the Meter System

The Editor of Municipal Engineering:

Sir—During the latter part of 1906 the proposition was placed before the voters of the city of Houston, Texas, as to whether the water works of the city should be purchased. For years under private management the service had been inadequate, despite every effort upon the part of the city council to remedy the

conditions, and with the past difficulties clearly in mind and with no hope for improvement, the proposition was carried by a large majority in October, 1906.

Immediately after the city assumed charge a thoro investigation was made into every phase of the plant and system, endeavoring to ascertain the specific faults and what plan to pursue to remedy them.

One fact was especially prominent, viz., negligent and wilful waste of water. The estimated waste was computed at 1,440,000,000 gallons yearly, and at that time only 108 meters were in service. Elimination of waste became at once the paramount issue, but, owing to adverse public sentiment, the city was handicapped to a great extent in adopting the meter system generally, so the policy of gradually installing meters in order to mold public opinion to their use was decided upon. It was proposed first to demonstrate the economical advantages accruing from meters, and second the conserving of the water supply so that a general reduction in rates could be made possible.

Three years have elapsed since the systematic installation of meters was commenced, and the water consumers have been benefited by securing a pure and adequate supply of water, reduction in rates, etc., while the water department has been able to make extensions and other improvements which would not have been possible under the flat rate plan.

It was deemed wise from the first for the city to own all meters, for obvious reasons, mainly to prevent the use of inaccurate meters, and to control absolutely the entire water works system. This plan has proven entirely satisfactory to all concerned.

Waste was found to be due to defective plumbing and wilful misuse of water. This was not confined to residences, but was discovered in the majority of manufacturing plants. Only 2 per cent. of the waste was attributable to leaky service pipes and mains owned by the city.

The equity and value of the meter system has long since been determined both by the consumers and the water department. Its justice is shown by charging only for water delivered. In comparison to the preposterous flat-rate plan of demanding payment for service whether given or not, this feature is very apparent even to the most prejudiced.

The value of the meter system, in addition to its financial asset, is its great aid in conserving the water supply. This alone is of vast importance to the people of the city.

In summing up the advantages resulting from the use of meters the following statistics will be found interesting: 8023 meters have been installed since the early part of 1910. In addition 277 new fire hydrants have been set, while the pumping capacity has been increased 94 per cent. The most pleasing result, however, is the substantial reduction in daily per capita pumpage, which in 1906 was 141 gallons and to-day, with an increased population of 50 per cent., it requires only 53 gallons per person. This has been accomplished without depriving any family, firm or corporation of this essential element, but is due to waste detection and stoppage.

All of the aforementioned improvements have been made without the issuance of bonds, which would not have been possible under the old system.

The chief aim of the Houston Water Department has been to serve the water consumers efficiently and to attain this end we earnestly asked co-operation from the consumers in conserving the supply and profiting thereby individually and collectively. Our efforts have been crowned with success, and the meter system has been the cause of enlisting each patron in the ranks of those whose aim is to secure an abundant and pure supply of water at a nominal price.

ROBERT L. JONES,
Water Commissioner, Houston, Texas.

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## Brush for Cleaning Tile Sewers

The Editor of MUNICIPAL ENGINEERING:

Sir—In re inquiry signed "E. R. W., Port Huron, Mich."

I had much success in cleaning tile sewers with steel wire brush I had made by J. Mullholland, 72 Lafayette street, New York. The brush was made on the principle of a boiler tube brush, the flat steel wires woven into a mandrel spirally 24 inches long, tapering slightly, but full 18 inches of brush full diameter of pipe to be cleaned.

At either end of the mandrel I had easy working swivel joint, to which the hauling and tail rope was attached. I found that in drawing thru sewer, if obstruction, such as roots or grease, was encountered, the swivel would allow brush to revolve and cut off obstruction and scrape surface of pipe clean. In section that showed much refuse, smaller size brush was passed thru and then brush of full capacity. At times I found it necessary to attach team of horses to line to draw thru. In bottom of manhole at invert I had two strips of oak about 24x1½x3 inches with blocks to separate them and a pulley sheave in manhole end; the other end of blocks were inserted in line pipe, and with hand winch on surface strain was directly up, causing the strain to be on wall of manhole and holding pulley in position.

A brush 24 inches long for a 10-inch sewer costs about $2.25.

W. W. DIXON, Elizabeth, N. J.

# CIVIC BEAUTY

EDITED BY MYRON H. WEST

## Chicago—"A City Set in a Garden"

BY CHARLES H. WACKER, CHAIRMAN, THE CHICAGO PLAN COMMISSION.

Next to convenience and orderliness in its street arrangements, the most essential thing in a great city is a park area sufficient for the preservation of the public health of the citizens. Parks of a city have been aptly compared with the lungs of a person, as means by which the city and its people get the stimulus of fresh air so necessary to normal well being.

The desire of the people of Chicago for extensive parks for their city has always been manifest. When Chicago became a city, in 1837, it chose for its motto "Urbs in Horto"—a city set in a garden; and in 1869 the people set about creating for the city a park system that should justify to the world that description of the city. In that year an agitation was begun to connect the existing parks by boulevards, and thus create a park system. This agitation succeeded, and with the addition of six of Chicago's largest parks to the city's open-air spaces the park system became the pride of Chicago.

It is universally admitted that attractive home surroundings, and those features of city life which contribute to man's judicious pleasure, are as vital in the development of a higher life as are the roof above his head and the food upon his table to his material welfare. Recognizing this, large sums of money are annually paid out of every city treasury for expenditures under the classification of "recreation."

Under "recreation" may be classed parks, boulevards, public conservatories, children's playgrounds, band concerts and other expedients that make life enjoyable to the great masses of people which make up a city's population. Chicago's expenditure for these purposes during the year 1908 was $1.43 per capita, while New York expended but 83 cents per capita for similiar purposes. The various park boards of Chicago alone expend six million dollars annually.

Chicago's present park area is divided into eleven districts—the South Park system, the West Park system, the Lincoln Park system, the Special Park Commission and seven smaller systems—the Ridge Avenue, North Shore, Calumet, Fernwood, Ridge, Irving Park and Northwest.

The South Park system, 2,495 acres in extent, embraces Jackson park, Washington park, Marquette park, Grant park, McKinley park, Gage park, Sherman park, Ogden park, Palmer park, Hamilton park, Bessemer park, Calumet park and eleven other smaller parks and squares.

The West Park system, 1,035 acres in extent, includes Humboldt park, Garfield park, Douglas park, Union park and ten smaller parks. A large new park has just been purchased which will form a large addition to this system and furnish recreation facilities for the people residing in the western section of the city.

CHARLES H. WACKER,
Chairman the Chicago Plan Commission.

The Lincoln Park system, 700 acres in extent, includes Lincoln park and several small parks. All these parks are connected by boulevards.

The Special Park Commission was created by the city in 1899 for the purpose of the development of a systematic and concerted plan for meeting the city's needs in the matter of breathing spaces of various sorts, including small parks and

playgrounds for children, and swimming places, public baths, parkways and the like. It has jurisdiction over sixty-five parks, seventeen playgrounds and two bathing beaches, and is constantly adding to its park acreage.

The parks are all beautifully wooded, with walks, drives, bodies of water for boating, bathing beaches, recreation facilities, flower gardens and athletic and picnic grounds. The smaller parks and playgrounds are equipped with play apparatus, shelters, sand courts, athletic fields, wading pools, running tracks and baseball diamonds, and in winter tobogganing and skating facilities are provided. Garfield park has the largest conservatory in the country, Lincoln park has one of the largest zoological collections in the country, and other parks have golf links, baseball grounds, tennis courts and other facilities for recreation and games.

Ten years ago a great Frenchman, visiting Chicago, made the statement that "Chicago had not yet discovered its lake front," and that was almost literally true at that time; but within the last few years the people have begun to exhibit a great yearning for the shore waters of our beautiful inland, unsalted sea. Take the entrance to Lincoln park, at the corner of North avenue and Clark street, for instance. The street cars there deposit on holidays, Saturdays and Sundays forty to fifty thousand people, largely from the city's West Side. Why? Because the people want and need the fresh and invigorating air nature intended they should have, because people generally love water. Chicago's location on Lake Michigan is unrivalled among the great cities of the world. A visit to Lincoln park on almost any hot day in summer affords convincing evidence that the people of Chicago have "discovered the lake front." Six thousand people in a single day have availed themselves of the bathing privileges afforded by the Lincoln park free bathing beach. It is not uncommon, as early as 9 o'clock in the morning, to see two hundred or more men, women and children standing in line at the entrance of the bath house waiting for accommodations.

The Chicago Plan Commission, to which the city of Chicago committed the plan of Chicago, originated by the Commercial Club of Chicago, has not been slow to realize the necessities engendered by modern day city life, and, in co-operation with the plan committee of the Commercial Club, of which Mr. Edward B. Butler, one of Chicago's leading public-spirited citizens, is chairman, bent its initial energies toward the carrying out of one of the greatest and most spectacular features of the plan of Chicago—the development of the south shore of the city's lake front.

This is one of the three great elements which make up the park plans of the future city under the plan of Chicago. The lake front to the south is to be improved, beautified and put at the service of the city's millions for the creation and preservation of public health. The central idea of the lake front park scheme is a plan for parks in Lake Michigan, reaching from Jackson park on the south to Wilmette on the north, a stretch of twenty miles of water front parks. These are not to be boulevarded for vehicles, but real parks and playgrounds for all the people, where family picnics, tennis and all manner of outdoor sports may be freely indulged in.

Beginning at Grant park, at the center of the city, the plans provide for the filling in, first, of a wide strip of shore land facing the open lake, this strip to extend solidly to connect with Jackson park on the south. The strip is to be planted with trees and given informal landscape treatment with flowers and shrubs, growing throughout its extent. Along this shore will run the water course for small crafts, for sailboats, motor boats, canoes and racing shells. Beyond the water course, built to protect it and provide safety and shelter forever of pleasure craft, will be a long island park, planted with trees, having winding walks and driveways, and providing frequent bathing beaches for the city's summer multitudes.

The development of the south shore of Chicago's lake front, as planned, in conjunction with that already completed, will give the city eleven miles of the most imposing water front of any city in the world. The work, however, will not stop there, but will be continued until thirty-five miles of the city's lake front have been developed as a park and put at the service of all the people. Thruout this magnificent stretch of lake front parks there will be frequent ways of access to the islands. Every half mile, perhaps, there will be a wide bridge, arching gracefully across the lagoons and waterways, inviting the people to recreation and rest upon the cool, airy, tree-shaded islands. There will be unlimited relief from the summer's heat for the city's millions and the citys' guests, and in winter unlimited enjoyment of all outdoor sports upon the frozen surfaces of the lake waterways.

The second element in park development proposed by the Chicago Park Commission, in accordance with the plan of Chicago, aims to create new parks upon a scale in accordance with the needs of the city, and, after a fashion, to express the size, wealth and importance of Chicago. Considering the shape of the city, the location of the great body of its citizens, the direction of future growth, the manner of laying out the streets and boulevards, and all other conditions affecting park plans, it was decided that the plan of Chicago

should provide three large city parks. There is to be one in each section of the city, and the plan is to connect the three by a boulevard, which in its scope and character will give the Chicago park system world-wide distinction.

Next in importance to the lake front development we may, perhaps, give place to the matter of securing for the people of Chicago large areas of forest lands adjacent to the city. These should be in their natural condition, filled with such wild trees, shrubs, vines and flowers as grow in this climate, and the people should have free access to them all for all time. Five sites have been designated in the plan of Chicago, which were selected with a view to getting the best lands for such purposes, the most attractive natural sites, and all readily accessible and near to all the people of Chicago.

Modern cities have learned that they must not confine their park land projects to their own limits, but must go beyond them and out into the open country to provide recreation areas for their people. Every European capital has its forest preserves or parks outside of its limits, but within easy reach of its people. Thus in summer, London, Paris, Berlin, Vienna and other cities are, on Sunday, deserted by their millions, the people dispersing to the open country park lands and the forests set aside for their use and enjoyment forever. In this country other cities are acquiring outer territory for park purposes, notably New York in its acquirement of the picturesque country along the Hudson river, and Boston in its acquirement of the forest preserve territory under the jurisdiction of the Metropolitan Park Commission.

In the plan of Chicago provision has been made for extending the existing park areas within the city, that wholesome and necessary recreation may be close at hand for all the people in all parts of the great future city. In addition provision has also been made for wide areas of forest and stream outside of the corporate limits, but upon the borders of the city, to be acquired and held in their natural state as places where the city-worn worker and his family may rest and wander freely in holidays and vacation time.

Nature has given Chicago the possibility of creating an outer park area entirely surrounding the city and immediately adjacent thereto. Glencoe, to the north of Chicago, lies in the center of a broken territory which affords a natural park entrance to the country from the lake shore. Piercing the country to the westward there is the Skokie marshland, almost as beautiful as the lake itself. A mile inland is the valley of the north branch of the Chicago river, where the ever-changing views give never-ending delights. Southward the forests extend along the river down toward and approaching the city limits, and comprise about eight thousand acres which should be taken for this great natural northern park. Extending westward from Glencoe is the proposed Desplaines river reserve, passing down that valley to Riverside. To the west lies the proposed Elmhurst and Salt creek reserve, including the valleys of Salt and Flag creeks, a country of great natural beauty. Mount Forest, the fourth proposed reserve, lies in a southwesterly direction, and includes the fine rolling country and forests in the Willow Springs district. Eastward from this reserve is the fifth proposed reserve, the Lake Calumet, including the region surrounding that body of water and the Calumet feeder, Stony creek and the little Calumet river.

The voters of Cook county in 1910 gave their consent to the creation of a Cook County Forest Preserve Commission, in accordance with the provision for the creation of forest preserve districts within counties in Illinois, which was authorized by the General Assembly of Illinois in 1909. Unfortunately, however, this favorable action was nullified by a legal technicality, and the Chicago Plan Commission, the Commercial Club plan committee and other interested bodies are at work to secure new legislation which will enable the city to secure the proposed areas without undue delay. An ordinance has been introduced in the Chicago city council looking toward the securing of the necessary state legislation, and the acquirement of the forest preserve territory outlined in the plan of Chicago and advocated by the Chicago Plan Commission should be secured at no distant date.

The present and proposed park and forest preserve area for Chicago, as contemplated in the plan of Chicago, and advocated by the Chicago Plan Commission, is 50,000 acres. Social experts all agree that there should be one acre of park space to every one hundred inhabitants of a city. Berlin is the only large city in the world which at the present time exactly measures up to that standard, with 3,500,000 population and 35,000 acres of parks. The park plans of Chicago will be ample to meet this standard for the next seventy-five years.

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## Steel-Taped Cables for Underground Wires

Success in present-day engineering is measured not alone by strength and efficiency, for beauty is at last recognized as a most essential element of the accepted design. Bridges and structures, heretofore deemed satisfactory if strong and serviceable, now create a storm of protest

if the element of beauty is lacking. Likewise the appearance of streets and boulevards is receiving a share of that attention which was formerly devoted to convenience and durability. Only a few years ago our cities were in a maze of overhead wiring, but now the wires have been placed under ground in the larger communities; the smaller places, however, have been seriously hampered in their efforts to follow this praiseworthy practice, because of the considerable cost of conduits for underground systems. With the advent of steel-taped cable the way has been cleared for further progress along this line. Briefly, the steel-taped cable provides an adequate substitute for the underground conduit system at a much lower cost. Its purpose is not to displace underground conductors in ducts where a permanent, flexible system and provision for suitable future growth is necessary, but rather to fill a particular need for which the conduit system is neither adapted nor required. This field includes the smaller cities, suburban districts, parks, private estates and manufacturing plants, and where local conditions do not justify the expense of a conduit system and flexibility is unnecessary. Western cities are considerably in advance in the installation of such underground systems. Lansing, Mich., St. Charles, Ill., Wausau, Wis., Austin, Tex., and Warren, Ohio, are among those which have used steel-taped cable in their ornamental street lighting systems. Kendallville, Ind., and Henderson, Ky., have employed it in connection with the decorative lighting of their public parks. These cities have used a regular lead-covered cable served with jute and tar, over which are two winds of steel tape in reverse directions with still an overall serving of jute and tar. The experience of these cities has shown a material saving in initial cost, due not only to the cost of the cable itself, but to the difference in the time and labor of constructing a conduit system and drawing in the regular lead-covered cable in the ducts over the installation of the steel-taped cable. While plans and expert superintendence are essential in the construction of a conduit system, the steel-taped cable is laid in a narrow, shallow trench and the earth replaced. The service record of this ready-made cable-conduit system has been so satisfactory as to give assurance of its success in the work for which it has been adopted.

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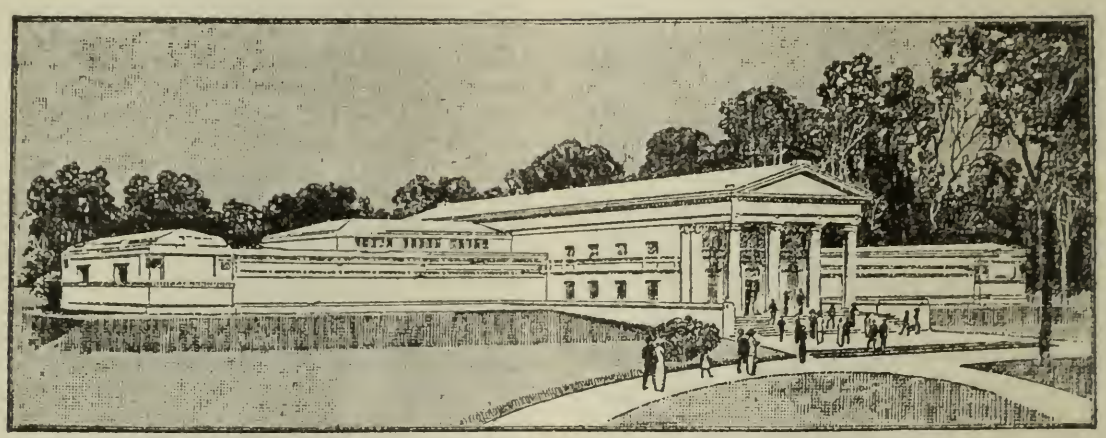
## The Municipal Mausoleum

The City Beautiful idea is extending to the problem of the cemetery. Municipal mausoleums offer a solution, especially for the larger cities. These structures, designed by the most expert architectural engineers, not only offer a practical method of displacing the cemetery, but at the same time may add greatly to the beauty of the municipality.



"ROSEHILL THE BEAUTIFUL," PROPOSED MAUSOLEUM, CHICAGO.

The community mausoleum, shown in the accompanying perspective drawing, represents this municipal mausoleum in embryo. It will be erected within the gates of "Rosehill the Beautiful," Chicago, at a cost of $300,000. Nothing so elaborate in workmanship and design, or so suitable, has before been attempted in America. It will be erected by the Community Mausoleum Company, of granite, bronze, marble, glass, concrete and iron, so as to make it practically indestructible by the elements.

The center of the building will be a large chapel, beautifully finished in marble and bronze, always freely at the disposal of patrons, providing a place for holding services with comfort and seclusion. Perhaps the most important feature is the complete system of ventilation and dessiccation provided. The crypts are hermetically sealed and faced with marble.

# WATER WORKS

## Hamilton, Ont., Has Trouble with Water Works Intake Construction

BY HUGH L. HUMPHREY, HAMILTON, ONT.

The city of Hamilton, Canada, is meeting with engineering difficulties to an almost countless number in the reconstruction of its general water works system. A year ago the civic administration, after putting the question to the people, appropriated nearly $1,000,000 for improvements and extensions, these to include new intake and crib, several new stations, a force main to cost $300,000, as well as new conduits, submains, etc. Plans were prepared, bids called for, and late last year most of the work was under way, all to be finished this year, the tenders being let in such a way as to spread the work over as many contractors as possible.

Trouble commenced early in the spring, when the rain came down in torrents for weeks at a time. The work on the two new pumping stations had to be abandoned for a month, which threw back a large portion of the other improvements. Great difficulty was also experienced in handling the new four-foot force main, which covers a distance of eight or nine miles. The workmen were unable to handle the big pipe until the city purchased a miniature railway, which it did at a large cost. This big pipe is being laid into the city now, and is the largest water main in this section of the country. Connection with the older part of the city's water service was made a few days ago, and proved an occasion of much anxiety to the city engineers. The sudden and increased pressure caused serious breaks in various parts of the city, which took days to repair. This resulted in the city being with almost no water pressure for several days, and caused a general protest from the insurance underwriters, who threatened the city with increased rates.

Hamilton's chief trouble at the present time, however, is in connection with the big intake pipe she is laying nearly a mile into Lake Ontario. Last summer the contract for this was let to John Danforth & Co., of Buffalo, the agreement calling for the pipe to be laid this year by the 15th of October. The pipe cost $60,000, and for laying it the Danforth people were to receive $31,000. Not only was the big pipe to be supported by piles, but was to have a covering of cement from the filtering basins to the lake shore, a distance of nine hundred feet. Although the Danforth company is under heavy bonds and forfeits $10 a day until the work is finished, only one length of the pipe has been laid, and that has to be redug, so as to concrete around it.

At a special investigation ordered by Hamilton's city council, the representatives of the Danforth company flatly admitted that they had been unable to do much work during the whole summer, in fact, said that they had spent $20,000 in preparing to lay the pipe, and now had only one length laid. The secretary of the company appeared before the Board of Control and told them that the work would be finished at any cost, as the company's reputation was at stake, and asked to be given until next summer to finish the contract. This City Engineer Macallum was against, but after much discussion the controllers agreed to give until next August to have the pipe laid and finished in all particulars. The company is under a $10,000 bond to do this, and still forfeits $10 a day.

There is no doubt that the Danforth people took on a greater proposition than they had any idea of when they agreed to lay Hamilton's pipe. This has to go out into Lake Ontario from a spot where there is absolutely no harbor or shelter for the workmen, and because of the lack of this knowledge the Buffalo concern is out about $20,000, with the intake still to be laid. Six distinct attempts were made to lay the pipe, the men working night and day in preparation, but on each occasion a storm would blow up and destroy all the supports, the wind carrying the wooden structures for miles along the lake shore, and in one instance carrying the pipe far out of its course. The main trouble seems to be that the company spent all summer spending thousands of dollars to lay the pipe, and left the actual work of laying until too late. This, however, has not been the only setback the

Buffalo concern has been forced to bear. Its representatives are being forced to pay twice as much for labor as others are doing, this principally because the work is on the lake shore and is an unpleasant job at the best. Ordinary laborers are being paid $6 a day, while teams demand $12, and it is because of this state of affairs that City Engineer Macallum figures that the Danforth company will be out many thousands of dollars on its contract.

The situation at the present time is that the council has agreed to give the Danforth concern until next August to finish up the work, and if it is not done then steps will be taken to collect the $10,000 in bonds the city holds and also the $10 per day forfeiture. The civic authorities believe that next year they will have to call for new tenders, despite the assurances of the Buffalo company's representatives that every effort will be made as soon as possible in the spring to rush the work to completion.

Danforth & Co. are also building the cement conduit between the basins and the pump house. Their contract calls for $30,000, and there is little doubt that they will finish this job all right and make a reasonable profit therefrom.

Hamilton has many other big waterworks projects on hand, and at the present time the city engineer, A. F. Macallum, is being assisted by two experts from Toronto in drawing up plans for a general overflow sewer system. It is estimated that this will cost between $500,000 and $750,000. Work will commence as soon as tenders can be prepared and let.

## Lighting for Small Towns and Villages

The problem of efficient illumination for small towns and villages has attracted a great deal of attention, and has seldom been worked out with entire satisfaction. While gas has ordinarily been used, it has been difficult to obtain a design of plant which would produce a gas suitable for both illuminating and heating or cooking, and which at the same time could be operated at a sufficiently low cost to make such a plant efficient. Several reports have been received from owners of plants installed by the Practical Gas Engine and Machine Works Company of North Chicago, which indicate entire satisfaction with this type of plant. The "Practical Gas Plant" seems to provide the ideal process by which gas can be economically manufactured for use in towns and villages having less than three thousand inhabitants. These machines cost, installed, from $1,500 to $3,500, depending upon the capacity. This cost is exclusive of buildings and mains.

In a number of instances private plants have been installed and a part of the product sold to neighboring residents. In such cases an earning of from eight to ten per cent. on the investment has been an easy matter. These plants require only a part of the time of a single operator, and the maintenance cost is practically negligible.

A. A. Herzog, of Harvard, Neb., writes that he produces eighty-two thousand cubic feet of gas from two hundred gallons of gasoline. From this gas he receives a gross revenue of $123, while the gasoline costs approximately $40, leaving a gross profit of $83 on this small plant.

The Practical Gas Engine and Machine Works have built and installed one hundred and sixty of these plants, many of which are owned by small towns in which a marshal looks after them as a part of his regular duties.

The gas used in this system is manufactured by a machine which unites under pressure 87 per cent. of gasoline and 13 per cent. of air. The mixture thus produced is claimed to have 35 per cent. more heat than is made from oil or coal. The manufacture of gas from gasoline is, of course, nothing new or untried. In most cities and villages gasoline lamps are being used in some form, and the principle is alike in all cases.

With the "Practical Alternating and Cold Process System" it is said that a better light is furnished than by the ordinary gravity pressure often seen in individual stores and houses, for the reason that the mixture of gas and air is made more scientifically and because of the steady pressure which the system furnishes. The Practical Cold Process plants are made in three sizes—600, 1,200 and 1,800 lights, each light of 70 candle power.

## Autos for Police Captains and Lieutenants in St. Louis

Eact of the fourteen police district om St. Louis has been supplied with an automobile runabout to be used by police captains and lieutenants in touring their territory. The machines are small two-seated Ford cars, especially constructed for speed and equipped with gongs similar to the automatic bells in use on many modern makes of fire apparatus.

Heretofore when it was necessary for captains or night lieutenants to go out into their districts it was necessary for them to use street cars. Automobiles maintained in all but the mounted districts for the use of detectives in emergencies have neevr been made accessible to commanding officers of the districts.

# STREET LIGHTING

## Street Lighting in St. Joseph, Mo.

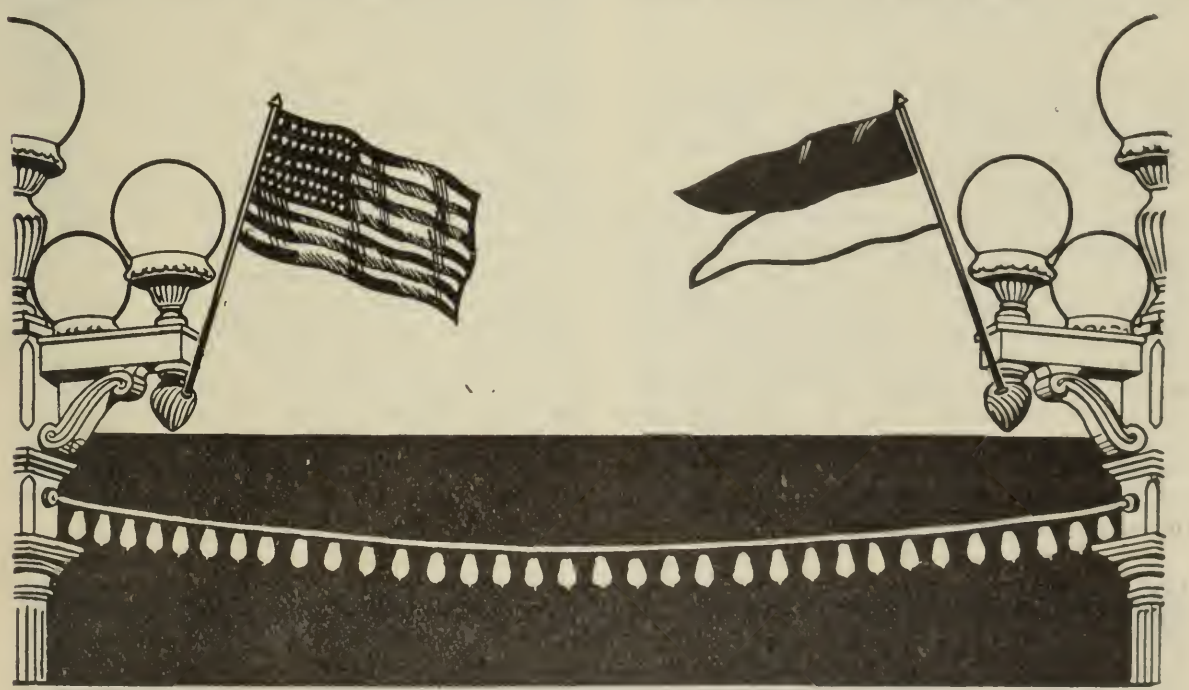
The city of St. Joseph, Mo., is acknowledged to be one of the best illuminated cities of its size in the country.

The city pays for the laying of cable and conduits in the business district, the St. Joseph Railway, Light, Heat and Power Company assumes all cost of ornamental poles and wiring, and the consumer pays a flat rate for the current.

The contract between the lighting company and the consumer reads as follows:

"The company agrees to install and operate a system of ornamental street lighting to consist of ornamental standards placed eight to a block (four on each side of the street), each standard to be equipped with five 60-watt and five 25-watt tungsten lamps. The company further agrees to maintain said standards during the life of this contract (five years). The consumer agrees to pay for such service $.... per front foot per year for a period of five years (or during his tenancy for a period not exceeding five years). My (our) proportionate share, based on a frontage of .... feet, to be $.... per year, payable quarterly in advance. Payments to be made on or before ten days from date of bill. The hours of service of said ornamental street lighting to be from dusk to 12 p. m., and one lamp in the top globe of each post burning from dusk until sunrise. This contract to take effect when electric power shall have been turned on in said lamp posts."

Two hundred "King De Lux" ornamental standards, No. 105, made by the King Foundry Company, of St. Joseph, are in operation. The standards average 1,100 pounds in weight and are made of special blended iron and steel.

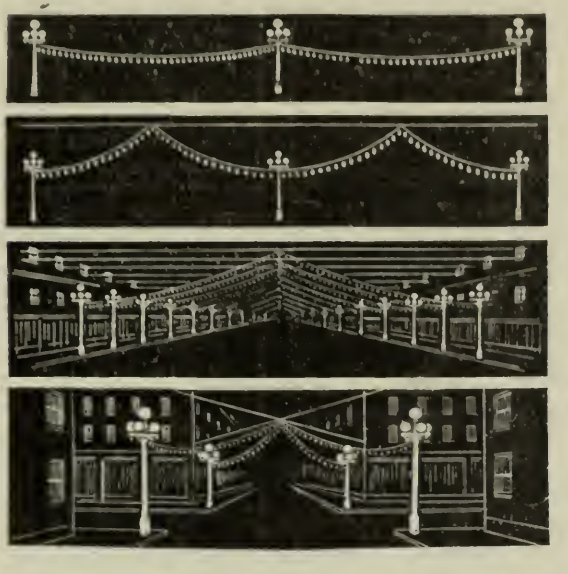


Ornomental Poles, Showing Sockets for Flags and Plugs for Festoons.

These standards have festive illumination connections and flag display stands.

These standards are made according to the King unit or sectional system. This sectional system idea applies to the entire equipment, but is particularly valuable as regards the arms, side and top lamps, and their accessory ornaments. By simple changes and additions the

same column can be altered from a one-light to a two, three, four or five-light cluster. Moreover, the four and five-light standards can be arranged either in the ordinary way with the four horizontal arms, or with only two arms carrying both upright and pendant lamps, all in the same plane. This makes possible the use of harmonious equipment throughout



Decorative Effects Obtainable Through Special Socket Attachment.

a city, and also permits the ready addition of more lamps to each standard as the importance of the street or the appropriation available increases.

This highly desirable flexibility is brought about by the employment of all standard parts accurately made to be entirely interchangeable. In each case the lamps on the side arms may be made upright or pendant, or subsequently reversed, if desired. Several designs of ornamentation are also available for the arms and brackets. All the designs are carefully proportioned to produce graceful effects and to give the appearance of solidity. The equipment is made of iron and steel of great strength.

The dimensions of the King De Lux standard adopted by the city of St. Joseph are as follows:

Height (to top of center globe), 14 feet 3 inches.

Base, 20 inches square.
Diameter of column at bottom, 8 inches.
Diameter of column at top, 7 inches.
Side globe fitters, 6 inches.
Top globe fitters, 8 inches.
Spread of arms, 44 inches.
Weight, 1000 pounds.

The socket connections save all expense of special wiring for festive occasions. The accompanying illustrations show illumination possibilities secured through this special feature. The city of St. Joseph can speedily and economically assume a festive street dress during holiday or carnival seasons, as well as bid welcome to conventions and celebrations of any description. The flag holders permit of the showing of national colors and insignia where they will loom up in conspicuous fashion either by night or by day.

"The globe breakage through wind, hail and jars by teams is exceedingly small," states F. C. Pullen, of the St. Joseph Railway, Light, Heat and Power Company. "We use five 60 or five 25-watt Mazda lamps per post. The average cost of maintenance per post is $5 per year. The consumer pays a flat rate of $1.15 per front foot of premises per year.

"The column proper contains about ¾-inch metal, while the arms, lamp bowls and ornamental castings on top of post contain about ⅜-inch metal.

"All of the ornamental castings on top of posts are well secured with stove or machine bolts, and well fitted together in such a way as to prevent water from getting inside the post. The bowls for holding the globes have a trap which will readily drain the water to the outside. The bowls are also fitted with brass screws, ready to receive the globes, each containing three screws.

THE WHITE WAY " IN SAINT JOSEPH.

# ORGANIZATIONS & INDIVIDUALS

## System of Passenger Subways for City of Chicago Urged by Harbor and Subway Commission

John Ericson, consulting engineer of the City of Chicago, is chairman of the Chicago Harbor and Subway Commission, which recently reported that: "Genuine rapid transit in Chicago is impossible without a comprehensive system of municipally-owned passenger subways radiating to outlying sections of the city." This commission has issued a supplemental report, showing needs and profits in a bore system.

The engineers defend their estimates of operating and construction costs with figures from the experience of other cities, and assert that profits would be certain.

"It would be impossible to have two distinct financial schemes, one for the surface lines and one for the elevated," says the report. "If this plan were followed the results would be an agreed valuation of the elevated roads. To this should be added the cost of making each of the roads a four-track structure and the cost of additional terminals, new rolling stock, and additional electrical power and equipment.

"Taking the value of these roads as represented by the elevated companies—$93,000,000—the necessary additions would be at least $40,000,000, making a total of $133,000,000.

"The purchase price of the surface lines February 1, 1912, was $127,500,000. This would make a total of $260,000,000 to start with, on which the companies would be allowed 5 per cent., or $13,000,000. The operating expense for 1911 for surface lines was $19,473,571, for the elevated line in 1910, $5,810,128, a total of $25,283,699, making a total for interest and operating expenses of $38,283,699. To this should be added interest on cost of downtown subway—5 per cent. on $10,000,000, or $500,000.

"The total receipts were about $37,900,000, or over $300,000 less than the amount required on the purchase price. In other words, the cost to the city would be the 55 per cent. it is now receiving from the surface companies. It would be simply turning the 55 per cent. traction fund over to the elevated roads to pay interest on a fictitious valuation."

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## Technical Associations

The American Institute of Architects has re-elected Walter Cook, of Newport, as president. The president and the Institute express themselves in no uncertain terms regarding the loss to the nation in artistic value of buildings and in their cost by the repeal of the Tarsney act, which now places the design of all public buildings in the office of the supervising architect.

The Indiana Good Roads Association held a three-days' "Better Roads Congress" in Indianapolis, December 11, 12, 13, at which almost 800 persons registered and gave the cause of good roads a decided impetus. The convention adopted resolutions which, among other things, declared in favor of a state highway commission, the classification of roads as state, county and township, the former to be exclusively in charge of the state commission; a state highway fund raised by taxation and vehicle license taxes, payment of all road taxes in cash, abolishment of road supervisor's office, protection of highways and the public safety thereon.

The American Society of Agricultural Engineers held its annual convention in Chicago, December 26-28. An important subject for discussion was the draft of specifications for a contest of gas tractors for farm purposes, which would be suited to conditions in the United States.

The New York Electrical Society, on December 19, made a special inspection of the new Grand Central Terminal passenger station at 42d street, which will be opened to the public in January.

Purdue University, Lafayette, Ind., will hold a conference of county surveyors, city engineers, county commissioners and other public officials for two weeks, between January 6 and January 18, with lectures and conferences on hydraulics, concrete, bridges, highways, accounting, specifications, sanitation, etc., in two divisions, one for two weeks for the engi-

neers and surveyors, and the other for one week for other public officials.

At its December meeting the Colorado Association of Members of the American Society of Civil Engineers discussed bills for licensing engineers, for a state public utilities commission, and for a state irrigation court.

A program of 26 papers on highway engineering has been prepared for Section D of the American Association for the Advancement of Science, which meets in Cleveland, O., January 3. Bonds, bridges, repairs, brick, bituminous, small stone block, patented, Topeka bituminous, bituminous gravel pavements, organization, traffic census, road surveying, analysis of materials, handling of materials, methods of testing, maintenance and construction, are some of the subjects treated by state highway commissioners, professors, city engineers, engineers of paving and material companies, chemists, and others who are experts in the field.

The goods roads congress held by the American Road Builders' Association in Cincinnati, December 2 to 6, was one of the most successful road meetings that has been held in character of program, in quality of exhibits and in interest manifested. The addresses and discussions were almost entirely devoted to problems of construction and maintenance, and as the speakers were mainly those who are in the control of the best work that is done, they were more than usually valuable. The stores of material offered will be drawn upon from time to time as opportunity offers.

## The San Francisco Exposition

The Panama-Pacific International Exposition buildings are under way, one approaching completion, one beginning in January, and parks and sites are being cleared and planted. Eighteen states have selected sites for buildings, and 21 foreign nations have announced participation.

## Canadian Mayors Elected

Mayors of cities in Canada have been eletced for 1913 as follows: Calgary, H. A. Sinnott; Edmonton, Wm. Short; Lethbridge, W. D. L. Hardie; Moose Jew, Jas. Pascoe; Prince Albert, N. W. Morton; Regina, Mr. Martin; Saskatoon, E. F. Harrison; Winnipeg, T. R. Deacon.

## Personal Notes

Alexander Potter, consulting and constructing engineer in hydraulics, sanitation and reinforced concrete, has moved his offices to No. 50 Church street, across Liberty street from his former location.

Mr. H. A. Paine, Assoc. M. Am. Soc. C. E., for seventeen years identified in railroad location and construction throughout the United States, and for the past four and a half years road engineer for Caroline county, Maryland, has resigned his commission, to take effect March 1, 1913. Address Denton, Md., until March 1, 1913.

Miss J. Arminson MacIntyre, for over ten years manager of the publicity department of the C. W. Hunt Company, West New Brighton, N. Y., is resigning that position early in the new year. While no definite plans have been made for the future, it is understood that Miss MasIntyre will travel for a time. Communications should be addressed care of the National Arts Club, New York City.

John G. Berquist, works manager of the Universal Portland Cement Co., has resigned that position, and will hereafter act in the capacity of consulting engineer. Leonard Wesson, superintendent, Plant No. 2, South Chicago, Ill., has been transferred to the general office of the company to assist President Edward M. Hagar in matters relating to appropriations, construction and operation. Mr. Wesson will have the title of assistant to president. Nels Nelson, who has been assistant superintendent of Plant No. 2, has been promoted to the position of superintendent of that plant.

Arthur H. Blanchard, M. Am. Soc. C. E., professor of highway engineering in Columbia University, on November 25th, delivered an address entitled "The Art and Science of Highway Engineering," at the celebration of Founders' Day at the Clarkson School of Technology.

C. B. Smith, formerly associated with the Atlas Dryer Company, of Cleveland, Ohio, has developed a new system of dryers which he is now placing on the market under the firm name of C. B. Smith & Co., 411 Prospect Hippodrome, Cleveland, Ohio. The company has issued a comprehensive catalog, giving full description of the new drying machinery offered.

R. W. Hutchinson, Jr., of the International Motor Company, of New York City, expresses decided and logical reasons opposed to the contemplated regulations restricting the tonnage of motor trucks on state highways. He advocates proper construction of roads to withstand motor truck traffic rather than any restriction upon the size and power of the equipment necessary to meet the demands of the times.

# MACHINERY AND TRADE

## Mineral Rubber Paving in St. Joseph, Mo.

"Good pavements are not only found in our largest cities, but in our smaller ones as well," states Mr. R. M. Davis, president of the Metropolitan Paving Company of St. Joseph, Mo. "We paving contractors of the less important cities have access to the same paving materials as the big city contractor; we have the same machinery at our command, and the taxpayers in our towns are just as particular as in the largest cities.

"Sarcolithic mineral rubber pavements have proven to be exceptionally satisfactory in St. Joseph.

"Our paving in St. Joseph has been the cause of a great deal of favorable comment on the part of visiting municipal engineers. We own our own asphalt plant, which is centrally located, and superintend each and every detail of the laying, because the durability, long life and evenness of wear depends in no small measure upon the care taken in the mixing and laying.

"The ingredients of the aggregate for mineral rubber paving must be thoroughly mixed, to furnish uniformly a minimum percentage of voids. The exact proportions of the aggregate and binder to produce best results must be rigidly maintained by accurate measuring devices.

SACOLITHIC MINERAL RUBBER PAVEMENT, ST. JOSEPH, MO.

"The proportion of automobile owners per thousand inhabitants runs higher in a city of 50,000 than in a city of 500,000, and consequently comparative values of different pavements are very carefully considered. Durability, low maintenance, ease of cleaning, low tractive resistance, freedom from slipperiness, sanitary properties, as well as initial and average annual costs are elements which enter into the situation.

"Our pavements are tough and resilient. They are subject to all kinds of traffic, and are kept thoroughly alive. Their semi-rough or gritty surfaces are a

non-skid footing for automobiles and horses. They do not wear glassy or slippery either during winter or summer.

"This type of pavement is capable of withstanding a range of more than 120 degrees F. variation without displaying any indications of cutting, chipping, contraction or expansion. It is as nearly noiseless as is possible, and the fact that it does not grind into dust is appreciated not only by the property owners, but also by the city, for the reason that sprinkling costs are lessened."

Mr. C. P. Hoff, assistant city engineer of St. Joseph, states: "We have approximately 260,000 square yards of mineral rubber and sheet asphalt paving on our streets, carrying both residence and retail district traffic. In certain parts of the retail district the traffic is exceedingly heavy. These asphalt paved streets compare favorably with other streets paved at the same time with other materials, and we are well pleased not only on account of the noiselessness of our streets, but because the maintenance or up-keep has been comparatively low.

"The total cost to the city for repairing asphalt streets for the fiscal year ending April 15, 1912, was $4,672.75. We clean our asphalt streets by flushing with fire hose. In addition to this, in business districts streets are cleaned by hand brooms and hand scrapers."

## Mixing Concrete Base

While care in the selection of good stone and sand and the proper proportion of a standard brand of cement, together with close attention to every detail of the laying, are requisites in the making of the pavement base, engineers cannot pay too much attention to the thoroughness of the mixing and the methods of distributing, else the results be deficient.

No shoe is better than its counter, and no pavement is better than its base. The base must be so carefully constructed that neither time nor the elements can change its ability to properly support the pavement proper.

Proper proportions do not guarantee first-class concrete.

Concrete evenness, solidity and permanency depend primarily upon the manner and thoroughness of mixing.

The Koehring Street Paving Mixer, which we use in our work, has a discharge chute which aids greatly in the proper mixing of concrete for pavement foundations.

In mixing, by the rotation of the drum the buckets cut through the contained material at the bottom and carry portions of it up and pour it from the side. The mixing blades also cut through at the bottom, and carry material up and discharge it alternately from end to end, breaking it over against the heavy heads of the drum. Material carried to sufficient height by both buckets and blades falls on the inwardly extending discharge chute, and flows off the inner end of the chute in a shower or sheet, the entire width of the chute. This action is precisely the same as a body of water dashing downward over rocks.

Since these three independent mixing actions are constant and opposed to one another, there is a continual intermingling of all the material in the drum, and practically three times as much mixing, which means practically three times as fast mixing, as would be possible with any one of these actions alone. The Koehring principle of three independent and opposed actions produces a perfect intermingling of the entire batch, and therefore absolute uniformity of product.

INTERIOR VIEW DRUM OF KOEHRING STREET PAVING MIXER.

Care should always be exercised in the adding of water, because when it is introduced in a flood, as is oftentimes the case, the cement is washed from the mixture. Water should never be added faster than it can be taken up by the materials. This machine is equipped with a water-measuring tank, which supplies the proper amount of water for each batch and applies it as the batch is mixing.

The Koehring machine is especially adapted for street work, as one man tends the machine and, without leaving it, mixes, delivers and practically spreads the concrete every minute in almost one continuous operation. The concrete is conveyed by a large bucket, holding the full contents of the drum, to the end of a long beam—20 to 30 feet in length—and there is automatically dumped and spread while the bucket returns to the drum to repeat the operation. The boom has a universal joint, and conveys the concrete at any angle from side to side.

## Etnyre Sprinklers and Flushers

E. D. Etnyre & Co., Oregon, Ill., in connection with a complete line of horse-drawn and motor-driven sprinklers, flushers and road oilers, are now manufacturing a very commendable and efficient motor truck street sprinkler and flusher combined.

These combination motor-driven machines range from 40 h. p. to 50 h. p., and in capacity from 850 to 1,400 gallons. The tanks are built of steel, but wood tanks are furnished if desired. The chassis on Model No. 5, 1,400 gallons capacity, has a frame of 6-inch rolled channel steel weighing 8 pounds per foot. The front axle is of a high-carbon steel, 2¾x2¾ inches, and the rear axle is of a 4-inch round high-carbon steel with Timken roller bearings. The front and rear springs are semi-elliptical. The motor is water-cooled, vertical, four cylinder cast in pairs, four-cycle, with 5-inch bore and stroke. The length of frame, 204¾ inches; the wheel base, 130 inches. The wheels used are of artillery type, with felloes full width of rim. Gasoline capacity is 20 gallons. Equipment includes two side oil lamps, oil tail lamp, horn and full set of tools. Maximum speed is 12.5 miles per hour.

The flushing attachments on Etnyre machines are adjustable, and can be turned in any direction and at any angle to the surface of the street to secure the greatest efficiency.

Any of the different models can be furnished with gravity type of sprinklers only, with pressure type of sprinkler, or in combination with flushing devices. The volume of water can be regulated by the operator as desired to correspond with the speed of the truck; and the pressure sprinkler device controlled to cover any distance from 10 feet to 90 feet. The pressure for flushing is obtained by the use of centrifugal pump, which is direct connected to the truck motors, and pressure is uniform. Any model of the flusher or pressure sprinkler can be equipped with device so that the tank can be filled from canals or streams when desired. It is claimed that the motor truck sprinkler will do the work of 4 to 6 horse-drawn sprinklers.

1. Drawing Water at a Distance of 25 Feet at Rate of 250 to 300 Gallons a Minute.

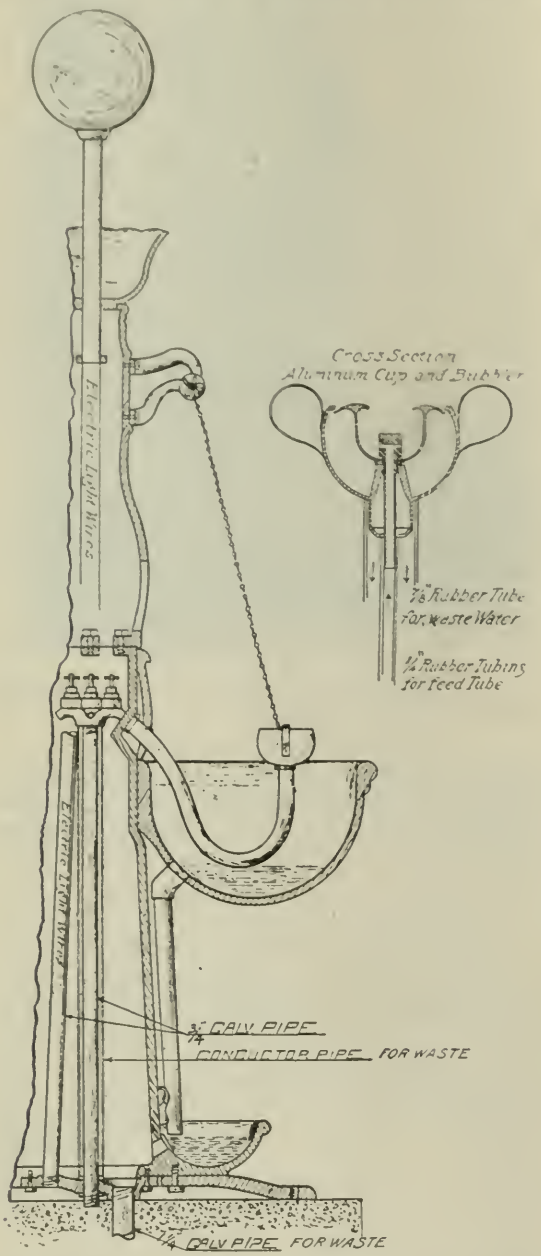
2. Possibilities of Etnyre Street Flushing Machine in Case of Fire.

## Sanitary Drinking Fountains

"Along with ornamental lighting standards ranks the ornamental drinking fountain as a means of really practical and useful ornamentation for streets and boulevards, as well as for business districts and parks," states a leading park engineer. "Public drinking fountains, however, should be constructed along strictly hygienic and sanitary lines, for what is not conducive to the health, usefulness or comfort of the individual is worthy of little consideration by the municipal official.

"Several leading municipalities last year installed a large number of drinking fountains in their business districts, and it can truthfully be stated that these fountains were not only not ornamental, but decidedly unsanitary. These same municipalities now realize their mistake. The fountains were so low in height that it was a common occurrence to see dogs drinking from them. The dogs were not

to blame. Fountains to be sanitary should be of sufficient height and the bubblers should be so protected as to be out of their reach. Those fountains with excessive continuous flows are decidedly wasteful and expensive in the long run. A drinking fountain should not only be ornamental, but it should be sanitary, it should have a continuous but not excessive flow in order to keep the bubblers in




SECTIONAL VIEW OF LANSING FOUNTAIN.

a clean and sanitary condition, it should also contain a special basin near the walk level for dogs and other small animals.

"The public drinking cup has been rightfully condemned, but when the low type bubbler took its place the small child, the woman, the tall and the fat man found they had no place to drink. To the child it is impossible; to the woman it is disgraceful; to the tall man awkward, and to the fat man—well, it can't be done."

The cut shown illustrates the cross section of an improved type of ornamental drinking fountain in which are incorporated several advanced hygienic features worthy of special notice. Briefly, the principal feature of the fountain is in the hose and cup arrangement, which consists of a double tube, the inner tube being the feed pipe and the outer tube carrying away the surplus water while the person is drinking.

The flow of water thru the inner tube is continuous, but not excessive, no matter what the position of the cup. When the cup is lowered the waste water flows over the edge of the cup (keeping it sanitary) into the large bowl. When the cup is raised, this waste water flows thru the outer tube, directly into the drain. This dual system of carrying away the water avoids any dripping or splashing and keeps the cup in sanitary condition at all times. The dog trough at the bottom is fed from the overflow of the large bowl.

The fountain is patented and manufactured by the Gier & Dail Manufacturing Company, of Lansing, Michigan. It has now been in continuous service for about two years, and has shown no indications of freezing, although last winter it was several times subjected to a temperature as low as 25 degrees below zero.

## Interlocking Street and Road Signs

An interlocking street and highway direction sign, so constructed that each individual sign becomes a strong and rigid truss, is manufactured by the Matthews Interlocking Sign Company, White Plains, N. Y. The manufacturer has also given especial attention to mountings and supports, and offers a complete line for attaching signs to iron trolley or lighting poles, wooden telegraph poles or buildings, as well as the individual sign poles for setting in concrete or in the ground. The best materials are used throughout, and the several practical tests show remarkable strength and durability. These signs have been extensively used, and have been consistently satisfactory. Prints showing full details of construction can be obtained from the manufacturers upon request.

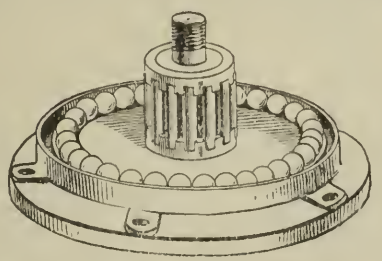
## Russell Grader Disc Plow

The Russell Grader Disc Plow, as used on the elevating graders of the Russell Grader Manufacturing Company, takes the place of the common mold board. It will plow through any material, such as fine sand, gravel, soft, sticky soil, old

ditches filled with rubbish and water, and will deliver the material perfectly to the apron and scour clean.

The rotating motion of the disc blade with its cutting edge enables it to handle all material successfully. It is surprisingly effective in sand, gravel and sticky soil; it cuts through dead grass and rubbish, delivering the material to the apron in the most satisfactory manner, and obviating the necessity of clearing the land.

The plow is mounted on ball and roller bearings. The bed-plate casting to the standard is machined true on its inner face, and contains a semi-circular case-hardened ball race in its periphery, in



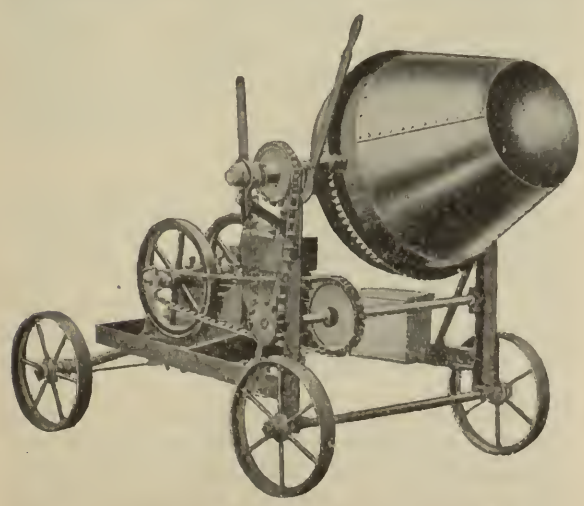
BALL AND RUBBER BEARINGS IN CASTINGS THAT HOLDS DISC BLADE.

which are carried thirty-two ¾-inch steel ball bearings. All are of the highest grade of material, machined true and adjusted with precision, making the adjustments of the plow bearing as perfect as those of a watch. The bearings run in hard oil and require little attention. The bearing casings are made absolutely dust-proof, and there is therefore no possibility of their being cut out with sand and dirt.

## Small Tilting Batch Mixer

Illustrated herewith is a concrete mixer of few parts and well balanced design, as made by the Cement Tile Machinery Company, of Waterloo, Iowa.

This machine is equipped with a 1½ h. p. engine, has a ⅛-yard capacity, and is mounted on a truck 3½ feet in width. Its height over all is 5 feet and its length 6½ feet. The machine is termed the "Contractors' Helper Mixer," as it is especially suited for little odd jobs on large contract work, or for use as an auxiliary machine.



THE "CONTRACTORS' HELPER" MIXER.

The Contractors' Helper is a machine of merit. It is of good size and weighs 1,000 pounds. It is constructed along the very best principles employed in concrete mixing machinery. This mixer has a capacity of one-eighth yard, or from three to four cubic feet, and under ordinary conditions it will mix a batch of concrete every minute, giving it a capacity of from twenty to thirty yards per day.

## Costilla Estates Tower

Probably the largest and most unique irrigation project in the United States is the famous San Luis Valley of Colorado, consisting of approximately 548,000 acres, and owned by the Costilla Estates Development Company. The holdings of this company include the southern half of what was originally the old Spanish "Sangre de Christo Grant" in southern Colorado, and extending into New Mexico.

The water necessary for the irrigation of this area is secured from an enormous reservoir, which under normal conditions is about two miles wide and five and one-half miles long. However, during high water the length increases to seventeen and one-half miles.

One of the interesting features of this reservoir is the controlling tower, a large reinforced concrete structure, 150 feet in height, 15 feet inside diameter, walls 3 feet thick at the base and 1 foot at top. The whole is set on a rock foundation with a 25x25-foot reinforced base 12 feet thick.

The walls of the tower were waterproofed with Ceresit compound, which was mixed with the water used in the concrete in the proportion of 12 parts of water to 1 part of Ceresit. The concrete mass was in all cases tempered quite wet. The amount of Ceresit mixed with the gaging water was increased or decreased according to the pressure of the water. Where the water pressure was low, 16 or even 20 parts of water may be used. When the concrete mass was waterproofed, a waterproofed cement mortar was not required, which saved the labor necessary for applying a cement mortar coat, and also the cost of material.

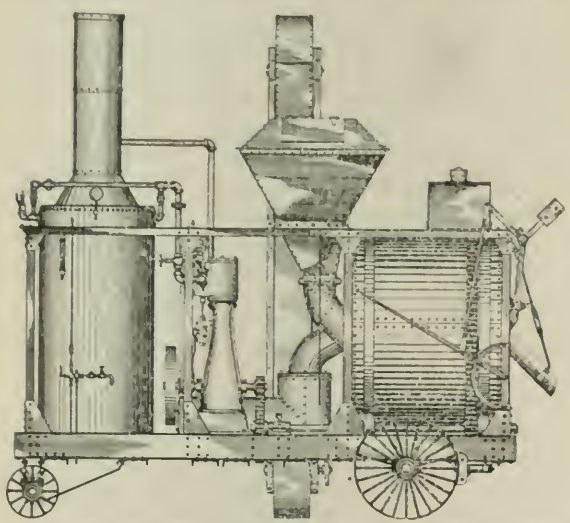
There are eight 30-inch openings in the tower walls at various elevations, placed so that at any stage of water in the reservoir the maximum desired capacity can be taken into the tower through any combination of three openings. On the outside of these 30-inch openings are placed

30-inch sluice gates for general use. These gates are protected from drift, debris and ice by heavy standard 30-inch gate valves for emergency use.

All the stems controlling the twenty valves with which the tower and outlet are provided are run through the floor of the valve house on top of the tower, and are to be under control of the valve watchman at all times. The raising devices are ball-bearing-geared stands of the latest design. The tower was built by the General Concrete Construction of Chicago.

## Equitable Asphalt Mixing Plant

The Equitable Asphalt Mixing Plant is being successfully used by several municipalities in melting and remixing old asphalt. When this plant is called upon to produce a load or two of binder, asphaltic concrete or bitulithic mixture, it is not necessary to make any change whatever in the plant.



EQUITABLE PORTABLE ASPHALT MIXING PLANT.

After the operation of the plant, if the drums are allowed to run a few minutes the heat thoroughly cleans and drives out all of the material.

The Equitable Asphalt Mixer is of steel construction, and can be built portable or semi-portable with one or more drums, as may be desired. Each drum is 8 feet in diameter and 7 feet long, turning on trunions, and is rotated by a vertical steam engine supplied with steam from a vertical boiler 44 inches in diameter. It has sufficient capacity for running the engine and oil burner, which is supplied with oil from a 300-gallon tank. The material comprising the mixture is charged into the drum in a wet or dry state in their proportions, then a blast of hot air without flame is passed through the drum, which in revolving causes the material to be cascaded through the large volume of hot air, until the moisture is driven from the sand or stone, at the same time causing the asphalt to melt under a temperature of 350 degrees Fahrenheit and adhere to the mineral aggregate, requiring about fifteen minutes to produce a perfect mixture. A very important feature of this process is the fact that the asphalt can be used in its solid state as it comes from the refinery, or, if desired, can be melted before it enters the drum. It requires but a few minutes to heat and mix the asphalt, and as a wagon load is mixed at a time and the sand and asphalt or stone being heated and mixed by the same heating medium, a perfectly uniform mixture is produced, and every batch alike, as it is proportioned while cold.

This plant is mounted on a steel frame having heavy wheels with broad tires, making it easy of traction, and can be drawn with four horses near the work, obviating long hauls. It is exceedingly simple and is very substantially constructed.

The two-drum plant will turn out 1,500 square yards of 2-inch asphaltic top in a day of eight hours. It can be built portable. It will mix binder and asphaltic top at the same time. It will mix any kind of street paving or road-building material without making any change whatever in the plant.

These machines are made by the Equitable Asphalt Maintenance Company, Kansas City, Mo.

## The Elevating Grader in Paving Work

The value of the Western elevating grader as an aid, particularly in the grading of streets preparatory to paving, is frequently overlooked by paving contractors. The cost of loading material into wagons, whether it be earth, shale, gravel or macadam, well mixed with small stones, is so insignificant, if compared with the expense of casting the material into wagons by hand work, that not a great quantity of work is required to make a saving equivalent to the original cost of the machine.

The machine can load wagons on a space 18 feet wide, including the room occupied by the wagons, so that it can take earth from the center of streets 36 feet wide from curb to curb, or, if the wagons are permitted to be driven on the parking, much narrower streets can be excavated.

Where all the earth cannot be taken out with the machine, it is generally economical to excavate as large a portion of the material as possible and load it into wagons, plowing up and depositing on

the side of the street the material that cannot be loaded directly into the wagons on account of the lack of width, and taking up this excavated material a second time and loading it into wagons. Even where the material is required to be handled twice, the cost of doing so is far below that for hand work.

The Western elevating grader, manufactured by the Western Wheeled Scraper Company, Aurora, Ill., is made in three sizes. The Junior, the smallest size, has frame 4 feet 6 inches wide by 13 feet 1 inch long; track, 6 feet 1 inch from center to center of wheels; equipped with 18-foot elevator, which can be shortened to 15 feet by removing one section. It will not carry an elevator longer than 18 feet without counterbalance, on account of the narrow base. The Junior is adapted for loading wagons, working in narrow cuts and turnpiking, or for other use where a narrow machine and short elevator are needed. The material used in the Junior machine is the same weight as that in the Standard, and the plow has the same capacity. Weight, about 8,600 pounds.

The Standard is the most popular size on account of its adaptability to general work. The frame is 6 feet 6 inches wide and 14 feet long; track, 8 feet 1 inch; furnished with elevator to make 15-foot, 18-foot and 21-foot lengths. On special order this machine can be supplied with 24-foot elevator, charge being made for this additional length of elevator. The Standard is equally good for ditch work as for loading wagons, turnpiking, building embankments, etc. Weight, about 9,400 pounds.

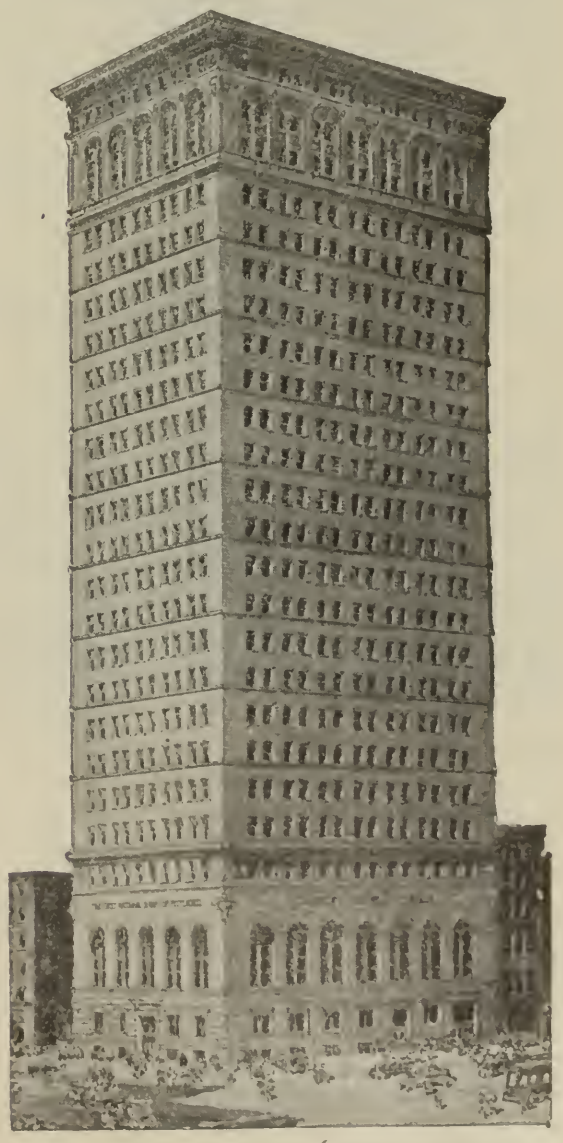
The Giant is a special machine which has been designed to meet the requirements for a longer elevator. It will convey earth a distance of 30 feet from the plow, the elevator being made in sections to operate, 18, 21, 24, 27 and 30-foot lengths. The frame of the machine is 7 feet 6 inches wide by 14 feet 6 inches long; track, 9 feet 1 inch. The Giant is necessarily of heavier construction throughout than either the Junior or Standard machine. It will excavate a ditch over 50 feet wide on top and to a maximum depth of 7 feet. Weight. about 12,000 pounds.

## How Modern 26-Story Office Building in Pittsburgh, Pa., Solved Its Smoke Stack Problem

The First National Bank Building of Pittsburgh, Pa., is located on one of the Smoky City's best business corners, is twenty-six stories in height, and of the latest and most improved type of modern fireproof construction throughout. The accompanying illustration shows this building. The first five stories of the exterior are constructed of gray granite, and the remaining twenty-one of terra cotta of a corresponding color. The interior finish is of the finest mahogany; the corridors are finished in white Italian marble; and the floors are of Tennessee marble.

The smoke stack, rising 400 feet in the air, is lined throughout with 2-inch J-M Vitribestos, manufactured by the H. W. Johns-Manville Co., presenting a solid interior surface impervious to gases, fumes and acids of combustion, protecting the metal stacks and insulating them from great heat.

Many smoke stacks are lined with radial brick about 5 inches thick, weighing 100 to 150 pounds per cubic foot. Large slabs of J-M Vitribestos, 3 feet by 6 feet, of 2-inch thickness, weigh, with all attachments, only 30 pounds per cubic foot in place, or about 5 pounds per square foot of stack area.



FIRST NATIONAL BANK BUILDING, PITTSBURGH.

## "Indestructible Drilled-In" Signs

"A sign that will last a century" is the name applied to unique and attractive street and road signs manufactured by the Indestructible Sign Company, 101 South Scioto street, Columbus, Ohio.

The accompanying illustration is an accurate reproduction of the sign as it appears when mounted and in use. It is made of solid ingot iron. The letters are drilled into ⅛-inch steel and are sunk 3-32 deep. The surface is of a brilliant black, being part of the material itself and not put on, as in ordinary signs. The entire sign is subjected to a rust-proof process, and the deep sunken letters are then filled with pure white cement. The white concave surface acting as a reflecting mirror, makes this sign perfectly legible at a greater distance than the ordinary flat-letter sign.

There is no enamel or paint to wear away, or rust to make the sign dim and unsightly. Signs of this character are made for any purpose whatever, varying in size from 2 in. x 2 in. up to 12 in. x 48 in., from steel, ingot iron, brass, copper, wood or any other material that can be drilled.

A sample sign will be sent upon request by the manufacturers to any one interested.

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## Construction of Two Types of Elevated Concrete Tanks

The Editor of MUNICIPAL ENGINEERING:

Although elevated tanks were the first important reinforced concrete structures ever constructed, and although there are some railroad tanks still in existence which were built over fifty years ago, the construction of elevated concrete tanks is still a novelty.

They have a great many advantages over steel tanks, especially in the northern climates, where the thick tank walls of the concrete tanks prevent to a certain extent the formation of ice, which under unfavorable conditions often attains a thickness of 5 feet or more.

Concrete tanks do not need any painting, thereby saving the expenditure of several hundred dollars every few years.

Concrete tanks can be made of monumental character at a very slight additional cost.

In the writer's opinion the reason for the comparatively rare use of concrete for elevated tanks is two-fold:

Firstly, the inexperience of engineers and contractors in designing and building an absolutely water-tight structure. In a reservoir which is placed in the ground wet spots in the walls or even slight leaks are not very objectionable, while in elevated structures they are sources of danger from frost and decidedly unsightly. While wet spots and slight leaks are often overlooked in wooden and steel tanks, they are sources of anxiety in concrete tanks.

Secondly, the cost of concrete structures is, as a rule, very considerably higher than of the steel structures, also on account of the inexperience of designers and contractors.

REINFORCED CONCRETE TANK, CHICAGO, ILL.
For Chicago City Railway Co., 120,000 Gallons Capacity.

The sizes of elevated tanks and their heights are increasing every year, and the cost of the bottom of the tank and its support are by far the greatest items of expense. The ordinary girder and slab construction for the bottom of large tanks is a very expensive affair. Loads of from 1,000 to 3,000 pounds per square foot require very heavy beams and slabs and a great many supports.

There is no more ideal design for tank bottoms than the dome and frustum shape bottom as shown in the illustration.

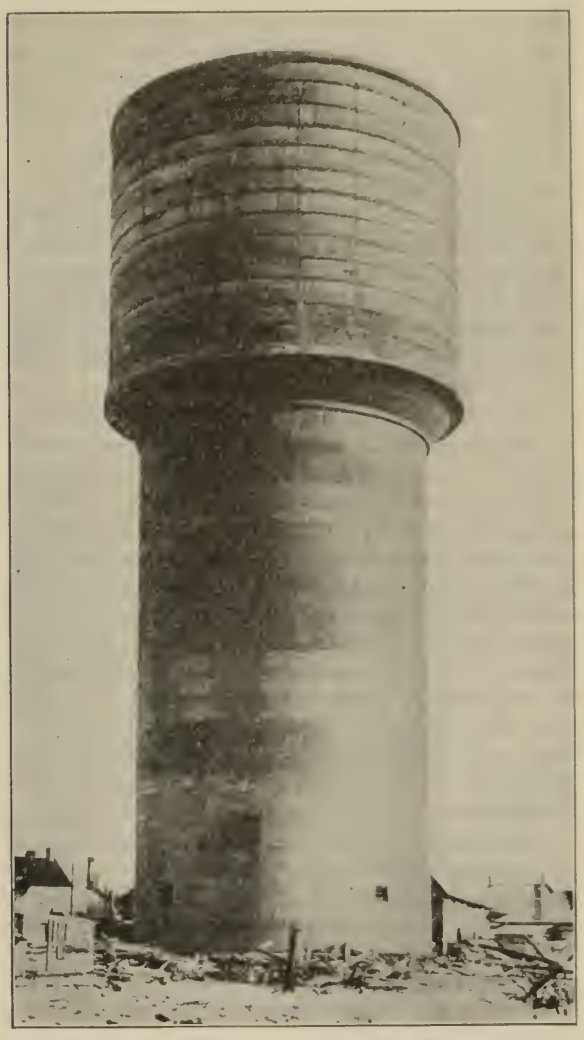
Concrete being an ideal building material for compression, is strained to its best advantage in this type, the inner

dome being only in compression in every direction and the frustum or inverted dome being in compression in one direction and in tension from water pressure in the other direction, at the junction of these two domes may be balanced by the adoption of proper inclinations and sizes of the domes, or there may exist a tension in the ring by the trust of the inner dome being greater than the thrust of the outer dome, or there may exist a compression by the thrust of the outer dome being greater than the inner dome. In most cases there is at this junction a very massive ring of concrete to take care of eventually changing conditions, for the tank empty, for the tank half full, or for the tank filled to its top. This ring may be supported by four or more columns, according to the size of the tank, in which case the ring must serve as a girder and be designed accordingly. On account of the comparatively small spans and great loads, these girders are designed mostly for shear and less for bending, and lend themselves well, thereby, for architectural treatment, as the rational form of such a girder is really an arch on top of the support. Where only four columns are used, this girder is subjected to considerable torsional moment, and must be designed accordingly.

Another way of supporting the ring at the junction of the two domes is to support it on a shell of concrete, or, as it is preferred in Europe, of brick or stone. If the shell is built of brick or stone, it is rarely made less than 18 to 24 inches thick, and although offering opportunity for elegant architectural treatment, it is very much more expensive than reinforced concrete shells, which can be made very much thinner.

A reinforced concrete elevated water tower and tank of the first kind was designed and built last year by the writer for the Chicago City Railway Company as part of a sprinkling system. It has a capacity of 120,000 gallons, although the overflow pipe is placed at the 100,000 gallon level on account of the requirements of the insurance company. A brass coil is placed inside of the tank about 2 feet clear of the bottom to prevent freezing in exceptionally cold weather. The supply and return pipes of the coil are encased in two legs of the supports, as well as two 6-inch riser water pipes.

The design of the tank and tower is shown in Fig. 1. The tower is composed of four legs, each 30x30 inches in section, reinforced as shown. The great spreading of the legs was necessary on account of straddling a dry kiln building over which the tank is built. The structure would have been sightlier if the legs had been spread only 30 feet at the bottom, as originally planned, rather than 45 feet, which it was necessary to adopt. The side wall of the tank is cylindrical in section and 8 inches thick. The roof is a portion of a spherical surface and 4 inches thick, reinforced with ⅜-inch round rods 12 inches on centers in both directions. The construction of the tank bottom is shown in Fig. 1. The inner dome has a spherical surface and is 8 inches thick, reinforced with ⅜-inch round rods 6 inches center to center in both directions. The flaring portion of the bottom, a frustum of a conical surface, forming the outer portion of the bottom of the tank, is also 8 inches thick and reinforced circumferentially with ⅝-inch square bars placed 5 inches on centers.



REINFORCED CONCRETE TANK, BERLIN, ONT.

For City Water Works. Capacity 2,600,000 gallons. Height 125 feet. Diameter 52 feet, outside.

The ring girder at the junction of the outer dome has at the center a cross section of 24x36 inches, at the columns a cross section of 24x48 inches, and is reinforced. On account of the inclination of the supporting columns, there is a

thrust on the ring girder, which is taken up by two diagonal beams 10x16 inches in section, which are reinforced top and bottom with four ½-inch round bars.

The supporting tower is divided into three equal panels 23 feet 4 inches high, and inasmuch as the dry kiln building prevents the use of any diagonal braces in the tower panels, all the diagonal tension and compression members were omitted and only horizontal struts were provided to bind the columns together and to take care of the wind stresses. These horizontal struts are 15¼ inches wide and 18 inches deep at the center and 48 inches deep at the junction of the columns. The stresses in the columns and struts from the wind pressure were determined by the elastic theory.

Work was begun on the construction of this tank in the middle of November, 1911, and it was finished late in April, 1912. For about 110 days work was entirely suspended on account of the cold weather, and the structure was actually built in less than ten weeks' working time. The tank was filled with water by three equal increments on May 1, 1912.

Before setting up any forms a wooden tower was built, 30x30 feet outside dimensions, of the shape of a Maltese cross. This tower consisted of twenty vertical supports, each composed of four or six 4x4 timbers and thoroughly braced by horizontal and inclined braces to withstand heavy winds, and besides guyed 40 and 60 feet above the ground by four ⅝-inch guy wires. This tower, which had to support a load of 400,000 pounds, was set on twelve 6x16-inch timbers 32 feet long, so that the weight was evenly distributed over the walls of the dry kiln building.

The tank forms consisted of two sets of cylindrical forms 4 feet high. Outside forms were kept from spreading by regular tank hoops by means of these forms, which made it possible to concrete the shell of the tank in one week.

After the tank was completed it was given three coats of plaster, one part cement, one part sand and one-tenth part of hydrated lime. The tank was filled about two weeks after this cement finish was put on the walls and before it was thoroughly set. There appeared a slight sweating at the junction of each day's work, and a slight leak at the bottom of the tank. Neat cement was rubbed on the inside near the places where the sweating appeared, which took a man six hours, and the tank is, as the engineer in charge, Mr. Hugo Smith, superintendent of buildings for the Chicago City Railway Company, declares, "bone dry."

A very much larger tank of the second type was completed by the writer a short time ago for the city of Berlin, Ont. This tank has a capacity of 500,000 im. gallons, equal to 600,000 U. S. gallons. Fig. 2 shows the design of this tank.

The tank is supported by a reinforced concrete shell 12 inches thick and about 80 feet high, resting on a circular foundation 13 feet wide.

The inner and outer domes are proportioned so that the thrusts nearly balance. At the junction of the outer dome and shell of the tank there exists a great outward thrust from the weight of the shell of the tank and of the roof, which necessitated the placing of a large amount of steel, and in order to secure the co-operation of the steel and the concrete there was provided a section of concrete at this junction of 18x30 inches.

The reinforcing of the tank consisted of ⅞-inch and ¾-inch square bars of high carbon steel and placed in two separate layers where the spacing was less than 4 inches. At the junction of the two domes a great excess of concrete was provided to take care of the thrust of the outer dome while the tank was empty or partially full. The reinforcing of the inner dome consisted of ½-inch rods placed from 6 to 8 inches centers, which rods were provided to take care of stresses due to the elastic deformation; otherwise the dome is stressed in both directions in compression only, and would not require any reinforcing.

A mixture of concrete of 1-1-2 or slightly richer was used in all portions of the tank in direct contact with the water. All the other concrete consisted of a mixture of 1-2 and 4.

The lower shell was built by means of wooden forms 6 feet deep, which were suspended from 1-inch rods imbedded in the concrete and 8 feet apart, which 1-inch rods served as a support for a hollow screw, the turning of which moved the forms up. It was found, however, that not more than 4 feet 6 inches could be concreted in one day. The forms for the inner and outer dome were supported on 6x6 Norway pine posts about 10 feet center to center. The forms for the concrete tank were built of twenty sections 3 feet 1 inch high and 8 feet long, and the outside forms were kept from spreading by regular tank hoops. Two sets of these forms were used, one on top of the other, so that one form always served to support the next while being set up.

In order to prevent a leak at the junction of each day's work, due to careless removing of laitance or insufficient tamping of the new concrete, a dam of sheet steel 6 inches wide and No. 28 gauge was imbedded 3 inches in the concrete at the end of each day's work. These dams came in lengths of 82 feet, which is one-half of the circumference of the tank.

The roof forms were supported on 4x4

uprights about 8 feet center to center. As they were 44 feet long they were braced in two directions every 10 feet.

The concrete plant consisted of a chain belt mixer placed near the center of the tank, which discharged the concrete into a hoisting bucket, which bucket ran inside of a wooden tower which was built of four 4x6-inch uprights suitably braced and 140 feet high. This hopper was raised by means of a hoisting engine placed about 50 feet from the center of the tank and outside of the structure. The hoisting bucket discharged the concrete into a hopper which was also placed inside of the hoisting tower, and from here was spouted through a system of pipes and flexible spouts into place. The hoisting tower, placed in the center, necessitated an opening in the bottom and the roof of the tank, which openings were closed and concreted after the rest of the structure was finished.

L. J. MENSCH,
Engineer and Contractor, Chicago, Ill.

## Motor Driven Oil Sprayer, Pawtucket, R. I.

The city of Pawtucket, R. I., last year purchased a 3-ton chassis and assembled the necessary appliances for spraying oil on streets under pressure.

To this 3-ton chassis are bolted 4-inch I-beams, and to these a tank of 800 gallons capacity, arranging the dimensions of the tank so that plenty of room would be left for the pressure pump between the tank and the seat. The pump, which is a Deming duplex, is also mounted on I-beams bolted to the frame, and is driven by a belt from the drive shaft. The pump pulley has a clutch, which may be disengaged so that the pump is not running while the car is empty or when full and on the way to the section to be oiled.

When ready to commence oiling, the clutch is engaged and pump starts, taking the oil from the bottom of the tank through a strainer and forced direct to the nozzles under 100 pounds pressure. While turning around to return for applying another strip, the pump is not shut off, and the oil being pumped returns to the tank through a relief valve, the nozzles being closed. The supply from the pump divides into three sections of steam hose, which supply the distributer pipe, which is in three sections, the center having five nozzles and the two outside ones having four each. These are Deming spray nozzles of the kind used for spraying trees. The nozzles are controlled by the parallel ruler motion, being opened by a lever from the seat and closed by a spring, which pulls them to when the lever is released. Everything is controlled from the seat beside the driver except the closing of a section of the distributer for oiling a narrow strip. The tank is equipped with a telltale for filling as the inlet is filled with a screen funnel. This opening is closed with a manhole cover when tank is filled.

The chief recommendations of a sprinkler of this pattern are the facts that the distribution is even, without puddles, and the rapidity of application. In the winter the spraying apparatus has been removed from the chassis and another body substituted, thus making a valuable car for trucking purposes.

During the year this truck has cared for a surface of 835,000 square yards, at a cost of $9,746.06 for oil and labor, making the cost per square yard for the season 1.17 cents. Adding $735.35 for supplies and repairs, makes the total cost per square yard for the season 1.26 cents.

The cost of this automobile sprinkler, complete, was $3,494.28, which, in comparison with others we have seen, is a very low price, while visitors engaged in this line of work proclaim this apparatus the best which has come under their observation.

## Trade Notes

The Universal Portland Cement Co. has just issued an unusually attractive calendar for the year 1913. An artistic grouping of photographs demonstrates, very clearly, the varied uses to which Universal cement is adaptable. Such a calendar is an ornament to any office.

The Pittsburgh Testing Laboratory announces that Mr. James Otis Handy, for twenty-three years chief chemist, has been appointed director of research and chemical engineering, and that Mr. Howard H. Craver, for fourteen years assistant chief chemist, has been appointed chief chemist in charge of their laboratories.

Roselle Park, N. J., awarded contract for 15,968 yards of Dolarway pavement to Bamberger & Chapman, Orange, N. J.

For a quarter of a century the general offices and Chicago laboratories of Robert W. Hunt & Co. have been in the Rookery. Owing to the inability to secure in that building the necessary space in which to conduct their very largely increased business, they will move, December 21, to the twenty-second floor of the Insurance Exchange building, Jackson boulevard, between Sherman street and Fifth avenue, where they will have ample space for their offices and both chemical and cement laboratories.

The H. W. Johns-Manville Co. announce the appointment of Mr. C. S. Berry as manager of their Atlanta, Ga., office, located at 31½ South Broad street, where their Atlanta warehouse is also located.

# IMPROVEMENT AND CONTRACTING NEWS

## ROADS AND PAVEMENTS.

### BIDS REQUESTED.

Clinton, Ia.—Jan. 14, 1913, 8 p. m. For furnishing all labor and tools, materials necessary for grading to the established grade, curbing and guttering with cement, concrete combined curb and gutter; for draining and paving with vitrified block on a 6-in. base and 1½ in. sand cushion or for grading to the established grade for curbing and guttering cement concrete combined curb and gutter and vitrified block between and 1 ft. outside of street car tracks and paving with cement concrete consisting of 6 in. base and 2 in. wearing surface. Approximate quantities follow: 11,166 square yards vitrified block pavement, 10,878 lin. ft., combined curb and gutter, 5 catch basins, 165 lin. ft. 10 in. catch basin pipe, 72 track inlets, 725 lin. ft. 8 in. track inlet pipe. Adjusting 9 pavements, 100 cu. yds. excess grading. For concrete, 25,036 square yards concrete paving, 11,776 sq. yds. vitrified block pavement, 10,878 lin. ft. combined curb and gutter, 5 catch basins, 165 lin. ft. 10 inch catch basin pipe, 72 track inlets, 725 lin. ft. 10 inch catch basin pipe, adjusting 9 pavements, 100 cu. yds excess grading. Certified check $1,000. C. J. Reusche, City Clerk.

Fort Totten, N. Y.—Jan. 15, 1913, 2 p. m. For the construction of macadam roads, cement walks, etc. Information on application to quartermaster.

Bryan, O.—Jan. 9, 1913, 12 m. For furnishing necessary labor and materials for paving West High street between the alley west of Beech street and the west corporation line and the intersection of Beech and Center streets and Beech and Wilson streets and Mulberry street from east line of Main to West line of Union street. Estimated quantity 25,200 square yards. Certified check 10 per cent. John A. Neill, Village Clerk.

Cincinnati, O.—Jan. 17, 1913, 12m. For the improvement of Gum Run road from Zion road to east of Miami road in Miami township. Bond $2,000. Stanley Struble, President.

### CONTRACTS AWARDED.

Birmingham, Ala.—A contract was awarded to the C. M. Burkhalter Contracting Co., to grade and macadamize Tappan street for $15,223. The paving will cover seven blocks.

Los Angeles, Cal.—The Barber Asphalt Paving Co. was awarded the contract for the paving and storm drain in Sunset boulevard from Normandie avenue to Hollywood boulevard, $74,564.35.

Los Angeles, Cal.—The contract on creosoted piling for the 670-foot wharf at Wilmington was awarded to the St. Helens Creosoted Piling Co., $21,293.25.

Peoria, Ill.—John McAllister has been awarded the contract for paving with brick State street from Prairie to Glen Oak, $13,527.98. Also for paving Globe street between Main and State streets, $5,703.50.

New Orleans, La.—The following paving contracts have been awarded: The Southern Bitulithic Co. were given the contract for paving of Clico street from Dryades to Magnolia, $29,687.50. The Standard Paving Co. was given the contract for surface drainage on the same street, $19,854.50.

Joplin, Mo.—The city council has awarded the contract for the paving of Sergeant place with liquid bituminous paving to Lloyd Burris, $14,668. The paving will extend from First street to Glenwood place.

Frenchtown, N. J.—Sigafoos & Poor of Riegelsville, have been given the contract for the construction of the first section of the Flemington to Frenchtown macadam road, $77,712.24. The road is more than six miles in length and the excavations necessary is 41,842 cubic yards.

Cincinnati, O.—The contract for the paving of West Eighth avenue, from the old St. Joseph's cemetery to the new St. Joseph's cemetery, a distance of over two miles, was awarded to Ed Ryan. The street is to be paved with bituminous macadam, $60,115.14.

Fremont, O.—The contract for the paving of Buckland avenue has been awarded to Siegler & Peardon. Estimated cost of improvement, $14,521.

Paris, Tex.—The Shelby Downard Asphalt Co. of Ardmore, Okla., has been awarded the contract for paving West Bonham street with rock asphalt, $43,044.04.

Sherman, Tex.—The Creosoted Wood Block Co., of Dallas, Tex., were given the contract for paving with wood blocks on a 4-inch concrete base, the following streets: Pecan street from Walnut to Crockett, Crockett south to Houston, South Crockett from Lamar to Cherry, Cherry to Walnut. Estimated cost, $32,900.

Terrell, Tex.—The Bert Hawn Construction Co. of Ardmore, Okla., has been given the contract for the paving of Moore avenue from Rockwall to the Texas Midland R. R., and intersecting streets from the Texas & Pacific R. R. to Mash avenue, as follows: Francis, Catherine, Adelia and Virginia. Estimated cost, $60,000.

Norfolk, Va.—The Continental Public Works Co. has been awarded the contract for paving 55,500 square yards of asphalt paving in the old Fifth, Ninth and Tenth Wards at $1.48 a square yard. Also a contract for 18,000 feet of curbing at 49 cents per foot.

Denver, Colo.—A municipal bond issue of $4,000,000 to be utilized in the construction of a network of good roads leading from Denver in all directions and reaching the principal points of interest located within 100 miles of the city is contemplated by the good roads committee. Dr. F. L. Bartleet, Chairman.

### CONTEMPLATED WORK.

Elgin, Ill.—The following street improvement by paving is contemplated: St. Charles street, $38,500; Division street, $27,500; Walnut avenue hill, $7,500; Villa street, $60,000; District No. 1 macadam

roadway, $66,000; Milwaukee street pavement, Spring to Center, $3,600; Riverside avenue pavement (alley in rear of opera house and both entrances) $7,000.

Rock Island, Ill.—The city is contemplating the paving with asphalt of Twenty-fifth street from Ninth avenue to Thirteenth avenue, at estimated cost of $12,273.50.

Waukegan, Ill.—This city is contemplating paving the following streets: Washington street from West street to city limits, estimated cost, $47,000, brick paving; Ash street, from Grand Avenue to Seward, Julian from North street to Ash street; Hickory stret from Grand avenue to Julian; Seward from Ash street to Williams, to be paved with asphaltic concrete, $35,800; St. James street from Glen Rock to Clayton to be paved with creosoted wood blocks at $10,600; also Clayton hill at $4,100 and Madison hill at $4,665.

Evansville, Ind.—This city is contemplating the expenditure of $20,000 for street improvements. The following streets are to be improved: Wabash avenue; Maryland street from Ninth avenue to St. Joseph; Michigan street from Main to First avenue; Illinois street from Garfield to Governor; Grang avenue from Washington avenue to Monroe street; Walnut street from the Standard Oil Company's plant to Kentucky avenue; Second avenue from Davison to Bond, and Fourth street from Chestnut to Blackford.

Kansas City, Kans.—The plan for the building of the Twenty-third traffic way on the Kansas side of the state line has been ordered. The entire structure will be 38,600 feet long and will cost $800,000.

St. Joseph, Mich.—A $500,000 bond issue for the extending of a net work of good highways through Berrien county has been voted.

Cleveland, O.—An ordinance has been passed authorizing the grading, draining, curbing and paving of the following streets: Lardner avenue to W. Ninety-eighth street; Evarts road from Grand avenue to E. Eighty-ninth street; Walworth avenue from Fifty-eighth to Sixty-fifth street; Wiley avenue from Scranton road to Big Four railway, and Coalgate court from Sixty-fifth to Seventy-third street.

New Philadelphia, O.—The paving of 2½ miles of streets is contemplated as follows: Fair street to North Broadway to Tuscarawas avenue; Tuscarawas avenue from West High street to the corporation line, and West High street from Sixth street to the B. & O. tracks.

Farrel, Pa.—J. Fred Thomas writes us that he is in the market for the following machines and materials: Curbing stone, paving brick, paving filler, paving tools and street cleaning machinery.

Monessen, Pa.—The improvement by grading, paving and curbing Knox avenue, between O'Neida street and Restraven street, is contemplated. Estimated cost, $10,568.48.

Houston, Tex.—The city officials have announced the repaving of Liberty avenue at a cost og $18,000.

Palacios, Tex.—Metagorda county has voted a bond issue to the amount of $100,000 to be used for the improvement of the public highways.

Smithville, Tex.—A $100,000 bond issue for road improvement has been voted.

Seattle, Wash.—This city is contemplating the paving of Twelfth avenue south to Judkins to Holgate, including Judkins, Atlantic, Massachusetts and Holgate streets, between Twelfth and Thirteenth south, at at estimated cost of $23.778.44. Also of Twenty-third avenue south from Norman to Atlantic at $10,022.94.

Toronto, Can.—A concrete road between Hamilton and Toronto, a distance of about forty miles, is contemplated. Estimated cost, $60,000. W. D. Flatt, Burlington, Can.

## SEWERS.

### BIDS REQUESTED.

Lebanon, Ind.—Jan. 13, 1913. For the construction of a sewer. Edmund Connor, City Clerk.

Tipton, Ia.—Jan. 15, 7:30 p. m. For the construction of sewers in certain streets and highways. Certified check $500. D. Ketelsen, City Clerk.

Houston, Tex.—Jan. 13, 1913, 12 m. For furnishing of materials and performing labor for the construction of the Fourth ward storm sewers. The work will approximately consist of 3,400 feet of 66-inch sewer, 900 feet of 8-ft. sewer, 5,550 feet of 9-ft. sewer, 1,550 feet of 10-ft. sewer, 46 manholes, 160 catch basins, 4,200 lin. ft. of catch basin connections. Certified check $13,750. H. B. Rice, Mayor.

### CONTRACTS AWARDED.

Titusville, Fla.—J. B. McCreary Co., of Atlanta, Ga., was given the contract for the installation of a waterworks system, $27,000.

Assumption, Ill.—F. E. Kaminske, at his bid of $32,000, has been awarded contract for eight miles of sewer in this city.

Mattoon, Ill.—The contract was let for an extensive improvement of Union District No. 3, a drainage system affecting Numboldt and Seven Hickory townships. The contract includes the laying of two and one-half miles of drain tile, two and one-half miles of open ditch work, the work going to two contractors, the tile work to Thornton & Michales, of this city, and the remainder to Louis & Wetherbolt, of Atwood. The cost of the drain will be $13,363 and the Mattoon firm receiving $9,180 for their part.

Petersburg, Ill.—The Herrick Construction Co., of Carlinville, at their bid of $12,495 was awarded the contract for putting in the sewerage system in this city.

Clinton, Ia.—Thos. Carey & Son were the lowest bidders for the construction of sewers in District No. 9, at bid of $20,756.

Atchison, Kan.—McGuire & Stanton, of Leavenworth, have been given the contract for constructing the White Clay creek intercepting sewer, at their bid of $31,661.

Detroit, Mich.—John Wagner & Sons, of Cleveland, have been awarded the contract for 4,000 ft. of sewer, at their bid of $121,600.

Detroit, Mich.—The following contracts on the Morrell street sewer have been awarded: Julian Porath, two sections, $132,852 and $98,829.97; John S. Affeld, one section, $93,616.80; and George Jeynes, one section, $51,183.

Canal Dover, O.—The Van Meter Construction Co., of Zanesville, was awarded the contract to build the city's sewer system for a bid of $16,492.21.

Lorain, O.—F. L. Baxter was the lowest bidder for the construction of a sewer in 28th street, from Toledo avenue to Elyria avenue. Price, $1,732.30.

Houston, Tex.—F. D. Horton & Son were the successful bidders for sanitary sewer work in the First, Fifth and Sixth wards, at the following bids: Fifth ward, $48,454.40; First and Sixth wards, $29,403.80.

Laredo, Tex.—The contract for the building of a sewer and water plant in Nuevo Laredo was awarded to the El Compania Ferreter, of Monterey. The improvement will cost $150,000.

San Benito, Tex.—J. Scott Brown, of this city, was given the contract for a lo-

cal sewer system. Contract price, $26,636.16.

Anacortes, Wash.—The Atlas Construction Co., of Everett, Wash., were given the contract for the construction of the M avenue sewer, at their bid of $10,907.79.

### CONTEMPLATED WORK.

Granite City, Ill.—The construction of an outlet sewer, at an estimated cost of $171,000, is contemplated.

Catonsville, Baltimore, Md. — Eighteen miles of sewer, at an estimated cost of $100,000, is contemplated. Disposal plant to be erected at Westport.

Akron, O.—An ordinance has been passed providing for the improvement of Abel street, from Washington to a point 200 ft. west of Grant street, and Bellows street, from Abel street to Crosier street, by constructing a sewer therein, together with laterals thereto for house connections. Ira A. Priest, clerk of the council.

Kenmore, O.—Sewage disposal and water works bonds to the amount of $170,000 have been voted.

Oklahoma City, Okla.—Sewer system bonds to the amount of $75,000 have been voted.

Du Bois, Pa.—The erection of a sewage disposal plant, to cost $100,000, is contemplated.

Farrel, Pa.—J. Fred Thomas writes us that he is in the market for the following sewer machinery and materials: Castings, catch-basins, manhole covers, municipal castings, vitrified clay pipe, sewer braces, sewer castings, sewer pipe and sewer rods.

Towanda, Pa.—Plans for a sewage disposal plant and system have been approved. Estimated cost, $96,510.

Austin, Tex.—A bond issue to the amount of $100,000, for sewer improvement, has been voted.

North Yakima, Wash.—Plans for the $250,000 sewer system have been completed by City Engineer N. A. Gilman. The construction of a sewage disposal plant is also contemplated.

North Yakima, Wash.—The construction of a sewer system to cost $274,000, including a 20-acre disposal plant, a main outlet sewer along the south city limits and two intercepting pipe lines running north in the east and west parts of the city, is contemplated.

## WATER WORKS.

### CONTRACTS AWARDED.

LaCrosse, Wis.—The following contracts in connection with the construction of the new well system have been awarded: Pumping station, LaCrosse Construction Co., $50,834; chimney, Weber Chimney Co., $2,475; low reservoir, Western Construction Co., $7,500; pipes, United States Cast Iron and Foundry Co., $14,690; valves, Chapman Valve Co., $2,245; high reservoir, J. W. Turner Improvement Co., $74,461; interior piping, John R. Kehn Co., $7,770.

### CONTEMPLATED WORK.

Burlingame, Cal.—An election here resulted in favor of issuing water works system bonds to the amount of $175,000.

Suisun, Cal.—A $20,000 bond issue for the improvement of the municipal water system has been voted.

Aurora, Ill.—The voters of Hinckley county recently voted in favor of issuing $12,000 bonds for the purpose of establishing a new water plant.

Chicago, Ill.—The Allis Chalmers Company, of Milwaukee, Wis., has been given the contract for designing, erecting and constructing at the 14th street pumping station, Harrison street pumping station, Central avenue pumping station and Springfield avenue pumping station, one horizontal centrifugal pump, driven by direct connected horizontal condensing steam turbine, with all auxiliaries, accessories, etc. Contract price, $83,500.

Evanston, Ill.—The election here resulted in favor of issuing water works bonds to the amount of $180,000. J. F. Hahn, clerk.

Muscatine, Ia.—This city is contemplating the expenditure of $100,000 for the improvement of the water works system.

Topeka, Kan.—This city has voted bonds to the amount of $45,000 for a water and lighting plant.

Frederick, Md.—A $60,000 bond issue to purchase the water-shed contiguous to the sources of the city's water supply and build a storage reservoir has been voted. Dr. Ira J. McCurdy, city health officer.

St. Paul, Minn.—This city is contemplating a bond issue to the amount of $1,000,000 for improvements and extensions to the water service.

East Liverpool, O.—A $250,000 bond issue for a mechanical filtration plant and other improvements to the water works plant has been voted.

Elmore, O.—A bond issue to the amount of $20,000, for municipal water plant, has been voted.

Frankfort, O.—A bond issue to the amount of $12,000 has been voted for a municipal water plant.

Sapulpa, Okla.—This city has voted $75,000 in bonds for water works extensions and other municipal improvements.

Freewater, Ore.—This city has voted in favor of issuing water pipe bonds to the amount of $12,000.

Homestead, Pa.—An $86,000 bond issue, for the construction of a filtration plant and the improvement of the Homestead water works, has been voted.

Galveston, Tex.—Water works bonds to the amount of $125,000 have been voted.

Marlin, Tex.—Water works bonds to the amount of $25,000 have been voted.

Montgomery, Tex.—A bond issue of $10,000 for water works plant will be voted upon in the near future.

Huntington, W. Va.—An $800,000 water system in this city is contemplated. Chas. R. Wilson, water works commissioner.

Mukwonago, Wis.—Water works system bonds to the amount of $14,000 have been voted.

Hamilton, Can.—A new reservoir, estimated cost $300,000, is contemplated. A. F. Macallum, city engineer.

## BRIDGES.

### BIDS REQUESTED.

Cincinnati, O.—Jan. 17, 1913, until 12 m., for the following work: Repairing floor of iron bridge over Great Miami river at Elizabethtown, in Whitewater township. Certified check $500. Stanley Struble, president of city council.

Cleveland, O.—Jan. 15, 1913, for the construction of bridge work, sidewalk and curb, South Rocky River bridge, in Rockport township. John F. Goldenbogen, clerk.

### CONTRACTS AWARDED.

Mobile, Ala.—The Nashville Bridge Company, of Nashville, Tenn., has been awarded the contract for a bridge over Dog river near its mouth. Price, $15.200.

Little Rock, Ark.—Hannan & Hickey, of St. Louis, have been given the contract for the construction of the Third street via duct. Contract price, $83,034.

Pineville, Ky.—Contract for the bridge across Cumberland river was given to the Roanoke Bridge Company at their bid of $15,000.

St. Joseph, Mo.—Contracts for building five concrete culverts on the road between Faucett and Dearborn were awarded as follows: C. H. Belcher was given the contract for the bridge at J. M. Radeck place, $3,185; J. A. Campbell place, $1,780; W. T. Maget place, $2,720. The contract for the culvert at the S. D. Hamilton place was awarded to the DuBois Construction Co. for $850, and for the one at the J. B. Stafford farm, $2,050.

Phoenix, N. Y.—Burleigh & Ingersoll, of Rochester, have been given the contract for the state's portion of the proposed river bridge at $198,000.

Lawton, Okla.—The Midland Bridge Co., of Kansas City, have been awarded the contract for the construction of 15 steel bridges, at their bid of $13,480.

Edmonton, Alta.—The contract for a bridge across the Saskatchewan, to cross at the foot of Fifth street, has been awarded to the Lyall-Mitchell Company, at $79,898.

Ottawa, Ont., Can.—An $80,000 contract has been let to the Canadian Bridge Co., for construction of steel bridge work over the Mamagush river and Canyon creek.

CONTEMPLATED WORK.

Rockford, Ill.—A new bridge at Morgan street, which will cost approximately $40,000, is contemplated.

Streator, Ill.—After much discussion, it has been decided to advertise for bids calling for bridges of both steel and concrete construction across Vermillion river, on the Deer Park road. Approximate cost, $23,000.

Minneapolis, Minn.—A concrete bridge, to cross the Mississippi river from the foot of Third avenue S. to a point just east of the old Exposition building, at estimated cost of $650,000 to $700,000, is contemplated.

Hamilton, Can.—Construction of a steel and concrete bridge over low level road is contemplated. Estimated cost, $25,000.

## GARBAGE DISPOSAL.

Peoria, Ill.—The purchase of ten garbage wagons, at an estimated cost of from $5,000 to $7,000, is contemplated.

Waukegan, Ill.—The erection of a $15,000 garbage incinerator is contemplated.

St. Joseph, Mo.—This city is contemplating the installation of a municipal incinerator or garbage reduction plant.

Janesville, Wis.—James Corse & Co. have been awarded the contract for the building of the new garbage incinerator, at their bid of $21,000.

## BUILDINGS.

CONTRACTS AWARDED.

Augusta, Ga.—The King Lumber Company, of Charlottesville, Va., have been given the contract for the Barrett and Lamar wings of the new city hospital, the amount of their bid being $122,029.

Waukegan, Ill.—The American Construction Co. has been given the contract for the new federal building, at $70,000.

Philadelphia, Pa.—J. E. & A. L. Pennock have been given the contract for the remodeling of the United States postoffice in Harrisburg, at a cost of $100,000.

Salt Lake City, Utah.—The James Stewart Co. New York, at bid of $1,106,000, was the lowest bidder on the construction of Utah's capitol building.

CONTEMPLATED WORK.

Chicago, Ill.—The erection of a $75,000 Immigration Station is contemplated.

Chicago, Ill.—This city is contemplating the erection of a $3,000,000 hospital.

Kewance, Ill.—Henry County is contemplating the building of a 120-room infirmary to cost $90,000.

Ft. Wayne, Ind.—A bond issue for a Municipal Convention Hall to the amount of $75,000 has been voted.

Garrett, Ind.—W. W. Mount, City Clerk, writes us that his city is contemplating the erection of a new city building early in the spring and that he is anxious to get in touch with some good, reliable architects.

Dayton, O.—A $200,000 bond issue for an addition to the Stivels Manual Training School has been voted.

Atoka, Okla.—This county has voted bonds for the erection of a court house to cost $100,000.

Denison, Tex.—A bond issue to the amount of $100,000 has been voted for the erection of a new high school building.

## AUTOMOBILES AND MOTOR EQUIPMENT.

Denver, Colo.—A fire truck of the aerial type, costing $5,000, is to be purchased for the fire department by Commissioner of Supplies Thomas.

Wilmington, Del.—The purchase of an auto fire truck at an estimated cost of $10,000 to $11,000 is contemplated. One of the specifications of the proposed truck will be that it will have an 85 ft. extension ladder.

Champaign, Ill.—A $5,000 bond issue for the purchase of an automobile fire truck and equipment consisting of 500 feet of hose has been voted.

Chicago, Ill.—The purchase of an auto for use in the detective department is contemplated.

Baltimore, Md.—The city is contemplating converting four horse-drawn engines into automobile engines and rebuilding the fireboat Cataract at an estimated cost of $65,000.

Elmira, N. Y., has decided to buy a motor hook and ladder truck. It is to be equipped with a 70 horse power engine and the estimated cost is $6,000.

Toledo, O.—A $200,000 bond issue to be used in replacing the horse-driven apparatus and patrol wagons in the fire and police departments with motor-driven apparatus has been voted. Safety Director, Mooney.

East Liverpool, Pa.—The entire fire department of this city is to be motorized. The first appropriation of $33,000 bonds for this purpose has been authorized.

Wilkes-Barre, Pa.—The purchase of all motor-driven equipment for the fire department is contemplated.

Galveston, Tex.—A $75,000 bond issue for the purchase and equipment of a fire station has been voted.

Montreal, Que.—The three road superintendents of the road department will be supplied with small automobiles costing about $2,000 each.

## LIGHTING.

CONTEMPLATED WORK.

Elgin, Ill.—A $150,000 bond issue for the municipal lighting plant is contemplated.

Whiting, Ia.—A bond issue to the amount

of $10,000 for the purpose of installing an electric light and power system is contemplated.

Topeka, Kans.—This city is contemplating the installation of a great white way. Estimated cost $10,000.

Tecumseh, Nebr.—The installation of a municipal electric light plant is contemplated.

Arcade, N. Y.—A bond issue to the amount of $9,500 to purchase an additional unit for the electric light plant has been voted.

East Liverpool, O.—A bond issue to the amount of $60,000 for a municipal electric light plant has been voted.

Camden, Pa.—This city is contemplating the erection of a municipal lighting plant at an estimated cost of $300,000.

New Castle, Pa.—A bond issue to the amount of $200,000 has been voted for the erection and installation of an electric light plant.

Sharon, Pa.—Sharon will build a municipal lighting plant which will cost between $65,000 and $81,000.

## STREET SIGNS.

Phoenix, Ariz.—The erection of road and street signs through the states of Arizona and New Mexico is contemplated.

Chicago, Ill.—The City Council has appropriated $54,000 for use in the erection of new street signs for this city.

Davenport, Ia.—About 2,000 street signs to be erected in the residential section of this city is contemplated. City is at the present time placing new signs in the business district.

Minneapolis, Minn.—This city is contemplating the erection of signs to be posted in the main roads and interurban lines, showing the location of the city limits.

New York, N. Y.—This city is going to put up 1,200 improved street signs in Manhattan at an expense of $9,000.

Canton, O.—The contract for new street signs will be let in the near future, according to Service Director Ruff.

Cincinnati, O.—A $10,000 appropriation for the installation of street signs throughout the city is contemplated.

Lima, O.—This city is contemplating the installation of street signs to be placed on iron posts 10 ft. high at the intersections of streets in the business district; also the placing of smaller signs in the residence district. These, however, will be attached to the corner houses.

Salem, O.—The placing of street designations at the intersections throughout the city is contemplated.

Wilkes-Barre, Pa.—A question soon to be considered by the street committee will be the adoption of a suitable street sign, to replace those that have been destroyed and to provide for new streets and lanes. Fully 2,000 will be needed.

Edmonton, Alta.—The renaming of 53 streets in this city is contemplated.

## PARKS.

### CONTEMPLATED WORK.

Washington, D. C.—A park to be located at the west end of the Q street bridge, to be built over Rock creek, and a highway to extend from the proposed park along the boundary of Oak Hill Cemetery to 29th and R streets, is contemplated. The area of land proposed is 142,500 square feet, or approximately 3.3 acres. Estimated cost, $31,000.

Chicago, Ill.—Secretary Mulger has been instructed to ask for bids for new buildings to be erected in West Park No. 6 and No. 7. Both parts will also have swimming pools and assembly halls. Estimated cost $250,000.

Chicago, Ill.—An outer park system for Chicago, to embrace 30,000 acres and to cost between $15,000,000 and $20,000,000, has been declared by Alderman Albert W. Beilfuss of the Park and Playgrounds Committee to be assured in the coming year.

Chicago, Ill.—The West Park Board has appropriated $25,000 for a new playground and natatorium in the south of Humboldt Park.

Waterloo, Ia.—The following park improvements are contemplated: Erect bandstand, with basement, in Lincoln Park. In the basement will be provided public comfort stations for men and women. Enlarge the Zoo at Cedar River Park by adding buildings for animals and increasing the species. Erect refreshment stands at the bathing beach to be under the sole control of the commissioners for the sale of lunches, cigars and soft drinks. Add new species of plants and flowers in the park and increase the floral areas. Oil the driveways in Cedar River and Prospect Parks. Develop Courtlandt and Byrnes Parks, which lie on opposite sides of the river below the packing plant. Place cable across the river and install ferry service between these two tracts. Take over the public square in Highland and beautify it.

Melrose, Mass.—Park and site purchase bonds to the amount of $9,000 has been voted.

Kalamazoo, Mich.—This city has purchased two blocks of land in the heart of the city and will convert the property into a park.

St. Joseph, Mo.—This city is contemplating the establishing of a park in the area bound by Holmes and Douglas and Thirteenth and Eighteenth streets.

Cleveland, O.—Playgrounds will be established at Woodland Hills Park, Fairfield Park and in the Italian colony on Mayfield road, in addition to the ones conducted last summer. The Woodland Hills playground will be designed especially for smaller children. The playground at Fairfield Park will be on the site of the old Kentucky street water works reservoir, now being leveled.

Toledo, O.—A $175,000 bond issue for park and boulevard purposes has been voted.

Muskogee, Okla.—An election here resulted in favor of issuing park bonds to the amount of $150,000.

Shawnee, Okla.—Park bonds to the amount of $50,000 have been issued.

Connellsville, Pa.—The leasing of Soisson park and converting it into a summer and winter amusement place, with a swimming pool, dance hall and skating pond, is contemplated.

Pittsburgh, Pa.—Westmoreland Country Club will spend about $50,000 for improvements to its golf grounds.

Providence, R. I.—Park bonds to the amount of $500,000 have been issued.

New Philadelphia, O.—The paving of 2½ miles of streets is contemplated as follows: Fair street to North Broadway to Tuscarawas avenue; Tuscarawas avenue from West High street to the corporation line, and West High street from Sixth street to the B. & O. tracks.

# MUNICIPAL ENGINEERING

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## ELLIS R. DUTTON.

*Assistant City Engineer, Minneapolis, Minn.*

*He has saved the city of Minneapolis approximately $75,000 every year for the past thirteen years on paving alone. Mr. Dutton has been eminently successful in applying the day-labor system to work of this sort. Since 1900, 2,400,0000 yards of paving have been laid in Minneapolis at a total cost of $5,500,000 and at a saving, under his method, of from 15 per cent to 20 per cent. He drafted what were probably the first creosoted wood block specifications, which prescribed the quality of oil essential to secure maximum durability.*

# Paving Conditions in Southern Cities

THE city of Birmingham, Ala., is now governed by a commission of three members, which has very large powers. It has now been in office about a year and is beginning to demonstrate its value. The members of the board are: C. Exum, A. O. Lane and James Weatherby. Their principal advisors in public improvements are the city engineer and his special assistant, Walter G. Kirkpatrick, and Maury Nicholson. The problems are numerous and difficult, for the city has absorbed all the neighboring towns and cities and is now something like 14 miles long and 4 miles wide, with large undeveloped areas lying between the various building and manufacturing centers. Before the combination each unit loaded itself up with public improvements, particularly streets and sewers, so that Greater Birmingham has a large debt to carry, and has much work demanding immediate attention in connecting the various sections of the great scattered city.

### Originating Improvements in Birmingham

*The new charter gives the commissioners authority to originate improvements and carry them through in spite of remonstrances, and to assess all the cost upon the property owners benefitted.*

The vacant condition of much of the property on the connecting lines and the large obligations upon the city at large make them slow to begin an improvement unless it is petitioned for by those directly interested.

Birmingham has excellent bitulithic and asphalt streets, which have required little repair and are apparently capable of retaining their present good surfaces for an indefinite period. Few, if any, of them have yet passed their guaranty periods and so the repair problem has not yet become important. The city officials recognize its imminence, however, and are very desirous of keeping the quality of the pavements up to the present high standard.

Prices have been kept at reasonable figures by promises of the paving companies to those signing petitions for pavements that bids would not exceed $1.70 per square yard. This price has been possible because the base is made of slag, of which there are mountains surrounding iron furnaces within the city limits, with cement made within the city limits, or but a few miles away. Limestone is also available at reasonable cost. Brick for paving, which is of quality good enough to compare with the materials in general use, is not available at reasonable prices. No streets have traffic heavy enough to demand granite blocks. Thus far the higher cost of wooden block paving has prevented its use largely, tho some excellent wood block paving will be found in street car tracks, where conditions are usually against success with this material.

### The Commission's Problem

The commission is confronted with a rather interesting situation. In its desire to meet the wishes of the property owner it awaits petitions. Many streets which are almost essential to a thorough system of paving are not paved if the property owners are left to their own initiative. Streets upon which the sentiment of the property owners is largely in favor of paving have that sentiment crystallized by means of a petition. It is

*Bitustone pavement on Poplar Street, Helena, Ark. Note excellent design of street and sidewalks where levels differ much on upper and lower sides of street.*

seldom that a property owner is willing to take the time and arouse the ill will of some of his neighbors by circulating the petition. It results that if the street is paved it must come from a petition circulated by the men next most interested in the pavement, the contractors who will bid on its construction. It is evident that the latter lose their interest also if the field is so open that the chances of success in obtaining the contract are reduced so much as to make the expense of securing the petition unwarrantable. The choice of the course of action to be taken by the commission is awaited with interest.

### Nashville Has Its Problems

Tennessee and Arkansas were long the only states which did not recognize the principle of local assessments for local improvements and paid for all public improvements out of the proceeds of general taxes. Their constitutions contain provisions that all taxes shall be uniform, and either state directly or are construed to say that they shall be in proportion to the value of the property. All other states recognize that improvements of such nature as streets, sidewalks, sewers and in some cases water and lighting service pipes or wires are of special benefit to the property served by them and should be paid for, in part at least, by the owners of the property so benefitted. The amounts so raised are considered rather as assessments of benefits than as proceeds of taxes, and, whatever the method of spreading the assessment, the principle of proportioning it according to the benefits to the properties assessed is the basis.

An early statute in Tennessee providing that property owners should pay the cost of improving streets out to the middle thereof was declared unconstitutional, altho sidewalks and curbs are considered as belonging to the property and if the property owners did not improve them the city could do so and charge the expense to the property on which the sidewalk and curb was laid. A law passed in 1883, authorizing Nashville to assess two-thirds of the cost of improving streets upon the property benefitted was repealed in 1909, and presumably had been inactive under the court decision noted.

*In 1905, however, the legislature provided for the assessment of two-thirds the cost of street improvements upon the abutting property in Knoxville, in 1907 the principle was applied to Memphis, and in 1911 to Nashville, so that the Knoxville rule now applies to all three cities.*

### A Successful Municipal Paving Plant

For some years before the change in the law Nashville laid pavements by day labor with its own plant. Nashville was the first city to purchase a municipal plant for laying bituminous pavements, making a special "introduction" rate with Warren Brothers Company for a plant to lay bitulithic pavement. There are several reasons for low cost of pavement. The

*Bitulithic pavement on First Avenue, Birmingham, Ala., with brick in car tracks.*

city, for example, owns its own stone quarries, within or close to the city limits, and crushes and hauls it to the streets, and with an average haul of a half-mile the cost does not exceed $1 a cubic yard on the streets. The stone is of superior quality and can be supplied by contractors at $1.10.

The labor at the plant consists of one man, who acts as engineer and fireman, a second man about the plant and three or four men at the drums, mixers, etc., all common labor at $2 for a 9-hour day. Warren Brothers Company furnish an expert at their own cost to supervise the operation of the plant and the laying of the pavement. Their representative in Nashville states that the resulting cost to the city of the completed pavement is $1.25 a square yard. The plant is operated during the summer time only, beginning in June or July and running until October, and as the city supplies only the common labor it is not obliged to retain an expert on an annual salary to insure good work, thus saving this expense in computing the average cost per square yard.

### Good Streets are the Result

The early pavements were laid in 1902 on the most heavily traveled streets and are still in good condition, altho they have required repairs from time to time on account of the heavy traffic on them. The city is well pleased with its method of obtaining good pavements and with the cost and the results obtained, and now that two-thirds of the cost can be assessed on the property benefitted it is probable that more paving will be done than in the past. W. W. Southgate is the city engineer and Patrick Cleary is the street superintendent under whom the work is done.

### Louisville Conditions

Louisville, Ky., is in still different condition regarding methods of securing public improvements and in paying for construction and reconstruction.

*The property owners may be assessed for the first street improvement, whatever it may be, and any subsequent improvement of the street must be at the city's expense.*

This is carried to such an extent by court decisions that a macadam road built when the property was outside the city limits has been decided to be the first improvement and a later city pavement must be paid for wholly from city funds. City streets when laid out in plats and additions may be improved with some similar cheap material at a time when such material is all that is necessary and the request for it can hardly be refused. But when conditions change, later, and a better pavement is required, the city must pay for the new pavement. The consequence has been that the demands for paving have been greater than the ability to meet them, and many expedients have been

tried to reduce the cost without diminishing quality too seriously.

### New Specifications

The present administration is issuing new specifications which conform closely with the standard specifications adopted by the municipal improvement societies, and has provided itself with a new rattler for testing paving brick by the latest method, and the necessary laboratory and field facilities for full test and inspection of materials and construction.

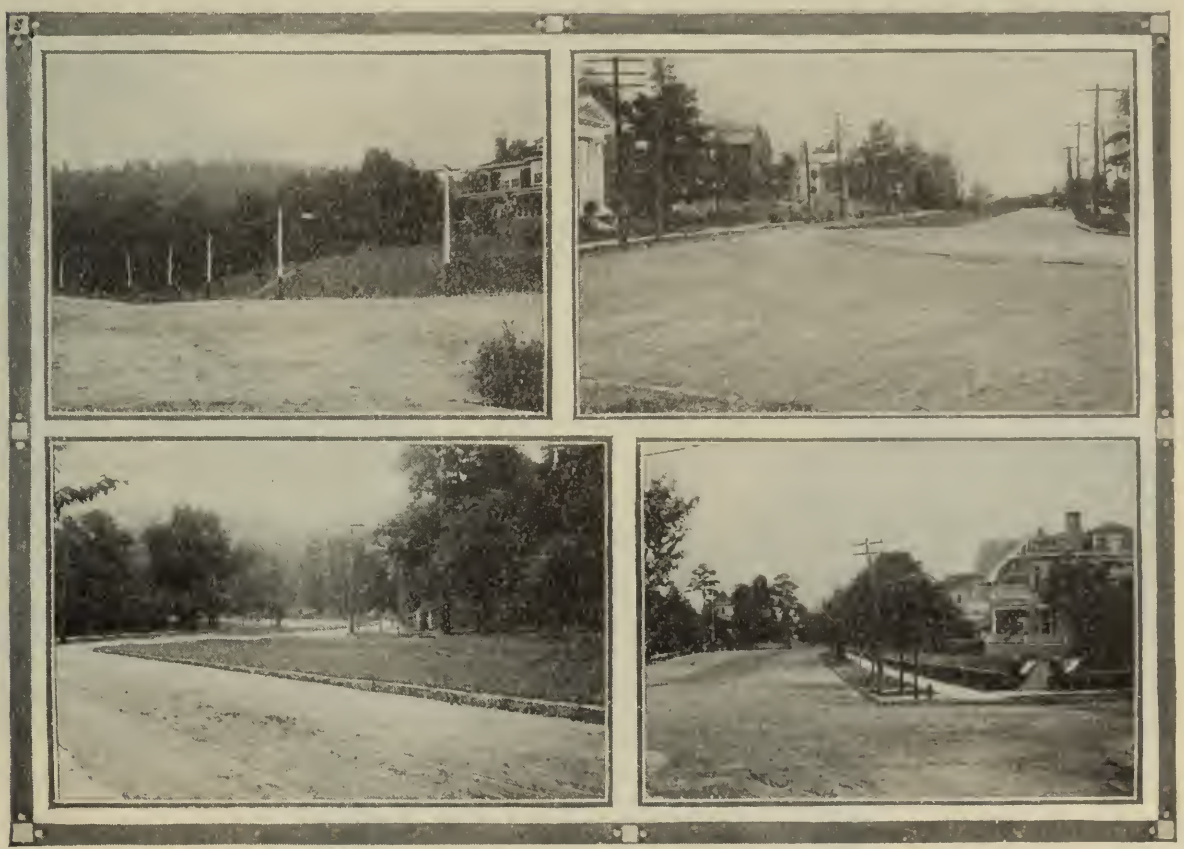
A recent court experience has led to this action as a necessary alternative to allowing the contractor to construct the street according to his own methods and accepting or rejecting the completed street. It seems that a brick street was constructed under the city's inspection, in which some defects developed after the street was finished and accepted. The attempt was made to force the contractor to put the street in good condition under his guaranty. While the contractor's claim that the fault was with the specifications and not with his workmanship was disproved by the evidence of several engineers with large experience in brick paving, the court held that the street was laid under the city's inspectors and with their approval, and, therefore, the acceptance of the street relieved the contractor of liability under his guarantee for the defects found. The case has been appealed and a reversal is expected in the higher court.

The alternative open to the city under this decision seems to be the construction of streets by the contractors without official action by inspectors, or the closest possible inspection under the most rigid specifications. Under the first the city may know in what ways the work is not properly done or in what ways the specifications are violated, and may even notify the contractor of the deficiencies, but will not relieve him of responsibility under his guarantee or from the liability of judgment against him in case suit is brought for damages on account of his violations of his contract. Under the second the city assumes all responsibility and no guarantee is necessary and it may be omitted from the specifications with a possibility that it will reduce slightly the bids for the work.

*Asphalt pavement on Main Street, Memphis, Tenn. Laid by Memphis Asphalt & Paving Co. in 1906.*

### Shall the Guaranty Clause Be Omitted?

The latter course is advocated by the city's engineers and they are prepared to follow it to the letter if it is adopted by the department of public works. The brick specifications adopted in September for work to be done in 1913 contain the guaranty clause, but they have been brought fully up to the standard specifications and in some respects have been made still more severe, particularly in the matter of laying. The standard of loss by brick tested in the new rattler is set at 21 per cent, as compared with 22 per cent adopted by both the municipal improvement associations for streets with heavy traffic. Experience in the case referred to above seems to have led to such requirements as those that the bricks shall all be thoroughly clean before laying; that the sand cushion shall be well rolled; that, if the sand in the sand cushion works up into the joints more than three-quarters of an inch during the process of laying and rolling, the blocks shall be taken up, the cushion restored to a smooth, uniform surface and rerolled if necessary, and the bricks relaid and rolled to proper grade and surface; that expansion joints be provided around manholes and catch basins and across the carriage way at intersections as well as at the curb, and that other transverse expansion joints shall be placed as shown on plans. Brushing the surface with a soft hair brush after the joints have been thoroly filled with cement grout by the aid of squeegees is an addition, intended, no doubt, to make the surface of the street as smooth and uniform as possible and to have no low joints.



*Four views of Highland Avenue, Birmingham. One of the finest residence streets in location and design in any American city. Paved with Bitulithic.*

### Work Done Past Year

During the last fiscal year, ending August 31, 1912, Louisville laid 15,573.5 linear feet of brick street pavements and 19,038.9 linear feet of asphalt pavements. The prices for brick paving averaged $1.83 a square yard, including the brick laid in connection with contracts for other pavements, the range in the brick pavement being between $1.75 and $1.90 a square yard, and some of the special brick work in connection with asphalt paving running as high as $2.35 a square yard.

Asphalt pavement prices averaged $1.91 a square yard, ranging between $1.75 and $2.05.

Cost of excavation in connection with pavement construction averaged 52 cents a cubic yard, range 25 to 95 cents; of embankment, 25 cents, range 10 to 45 cents; of curbing, 83 cents a linear foot, range 70 to 95 cents; curved curbing $1.42 cents a linear foot, range 80 cents to $1.57; binder or marginal stone 69 cents a linear foot, range 60 to 81 cents; binder stones reset 27 cents, range 19 to 70 cents.

*Asphalt repair wagon used in Chattanooga, Tenn.*

The parts of streets constructed were all short, ranging in length from 30 feet to 1,336 feet, but 6 of the 77 contracts covering more than 900 feet of street.

The city reconstructed 22,292.1 linear feet of streets, of which 13,466.7 feet were asphalt, costing 95 cents per square yard, not including concrete base; 3,373.1 were brick, costing $1.60 a square yard; 578 feet were asphalt macadam, costing 75 cents a square yard; 920 feet were treated with tarvia after grading by the city's force at a total cost of the work complete of $1.19 a square yard, and 1,073.4 feet of wooden block pavement at $2.89 a square yard, replacing an old brick pavement.

The city relaid 3,800 linear feet of granite block pavement, using its own force, at a cost of $1.54 a square yard; 432 feet of brick street for $1.96 a square yard, and 606 feet of asphalt street at $1.38 a square yard.

*Bitulithic pavement on Broad Street, Nashville, Tenn., laid in 1903. Car tracks paved with same material. Union Station tower on background on the right.*

Contracts for asphalt streets were distributed among the following contractors: Henry Bickel Company, Louisville Asphalt Company, Barber Asphalt Company, American Standard Asphalt Company. Brick street contractors were G. W. Gosnell, L. W. Hancock Company, L. R. Figg Company, Jefferson Construction Company and F. G. Breslen. D. R. Lyman is city engineer and E. B. Schmidt is assistant city engineer.

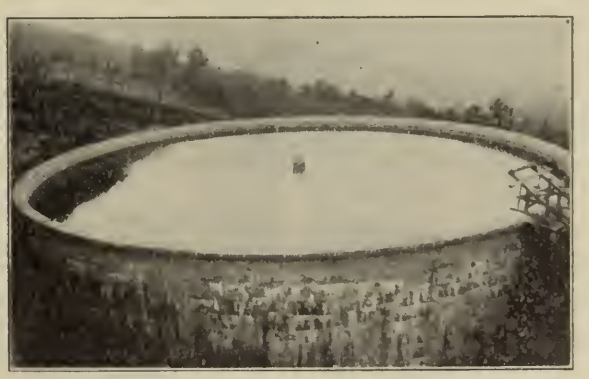
*Asphalt pavement on Wellington Street, Memphis, Tenn. Laid by Memphis Asphalt & Paving Co. in 1903.*

# FIVE-MILLION GALLON RESERVOIR.

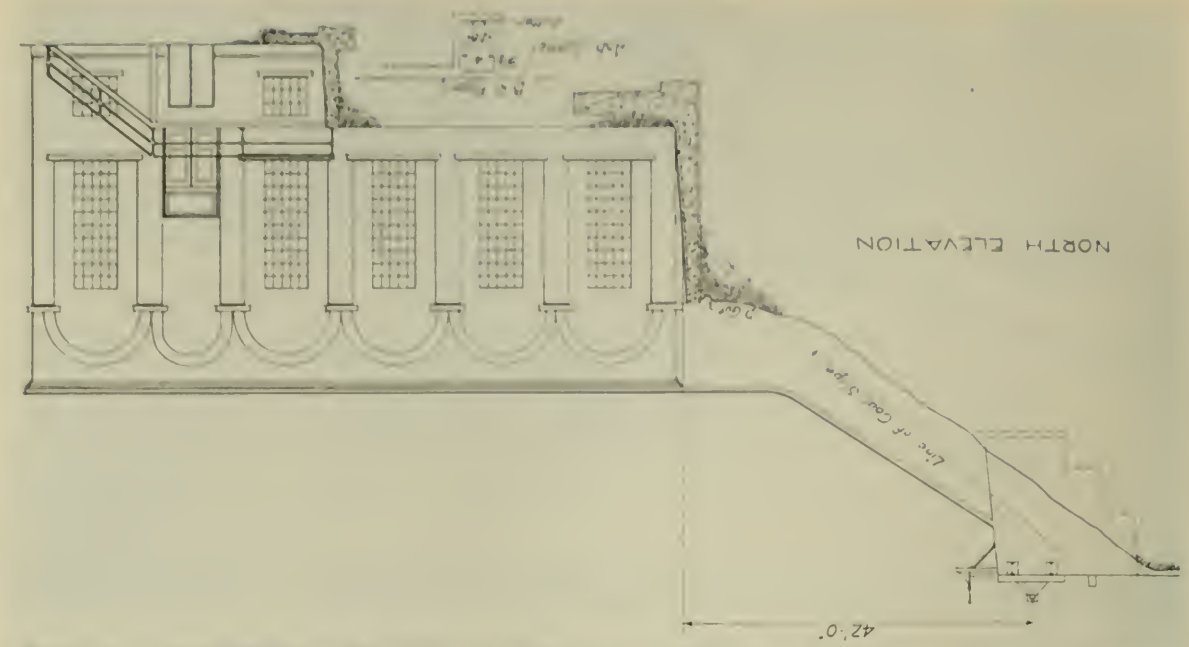
By Frank C. Perkins.

THE construction of a large reinforced concrete reservoir built to insure an auxiliary or emergency supply for the water system of Asheville, N. C., may be seen in the accompanying illustration. It has a capacity for 5,000,000 gallons of water and measures 150 feet in diameter at the bottom and is 40 feet deep. The wall is 3½ feet thick at the bottom and tapers to a thickness of 8 inches at the top. The reservoir holds a quantity of water sufficient to last the city three or four days, during which could be repaired any breaks in the pipe line, nearly 20 miles long, to the intake in the mountain from which Asheville is directly supplied with water.

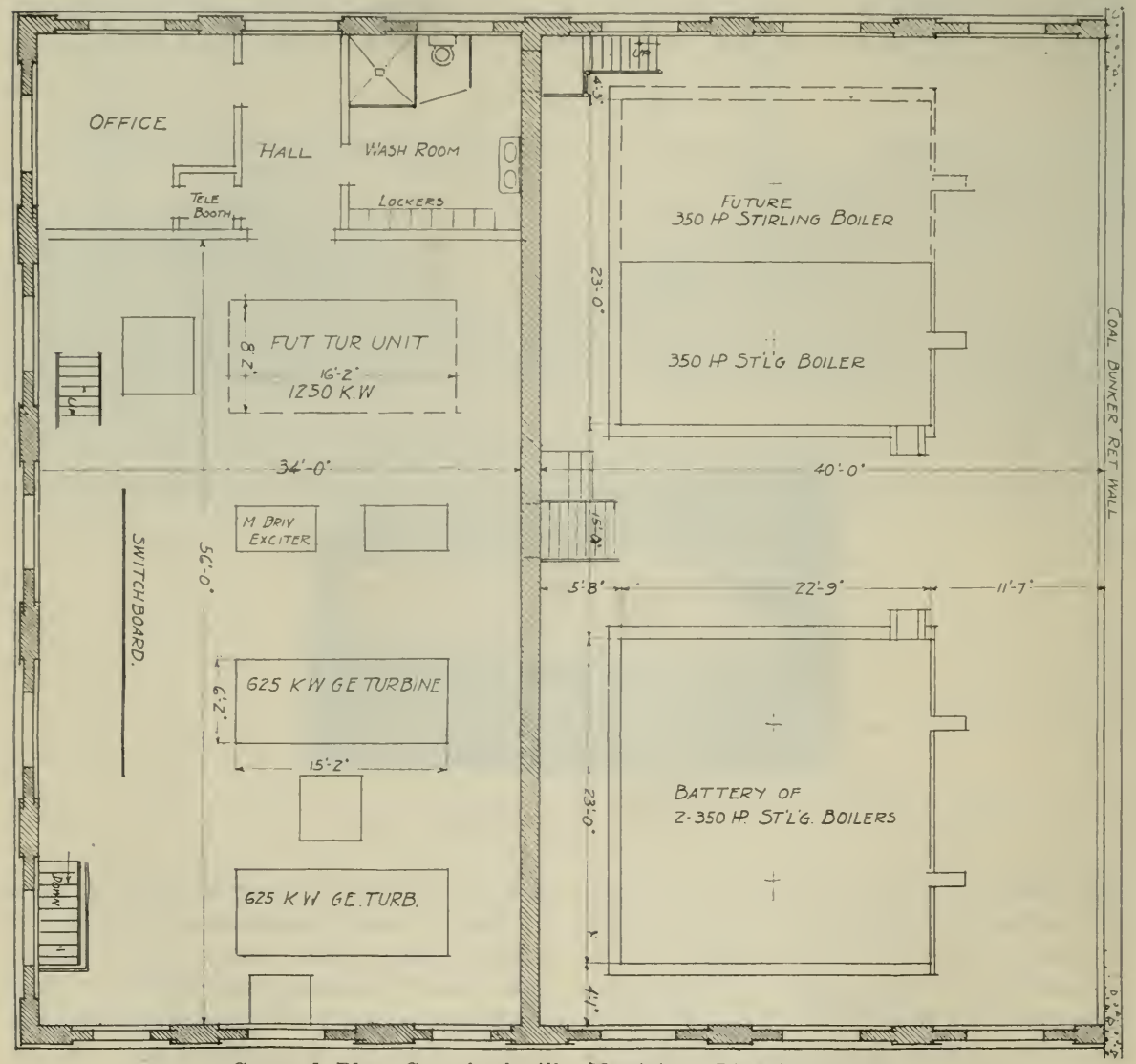
It has been stated that as first constructed the reservoir was not satisfactory, but was reconstructed and given a thorough test, the work being done by Geo. H. Davidson, of Asheville, who laid an entire new floor 8 inches thick, using 900 barrels of Lehigh portland cement, 20 tons of ½-inch reinforcing steel, 500 yards of 1-inch broken stone and 3 tons of Trus-Con water proofing composition. This work cost $11,000, bringing the total cost of the reservoir to about $47,000.



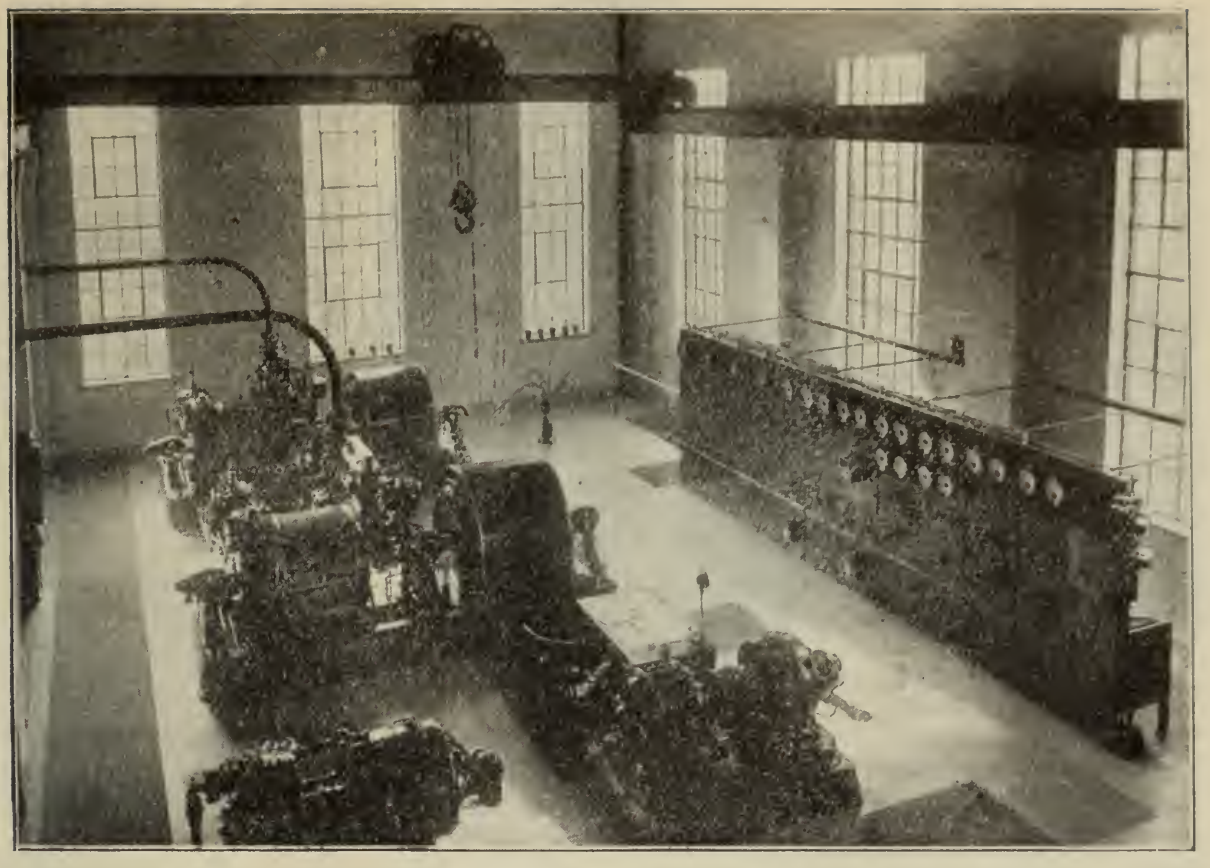
*Concrete Water Tank at Asheville, N. C., of 50,000 Gallons Capacity*




*Elevation Crawfordsville Municipal Lighting Plant, Showing Advantage Taken of Natural Conditions.*




*General Plan Crawfordsville Municipal Lighting Plant.*



*Turbin Room Crawfordsville Municipal Lighting Plant.*

# A Successful Municipal Lighting Plant.

AFTER twelve years of unsuccessful operation of its municipal lighting plant, the city of Crawfordsville, Ind., was finally awakened to the fact that its plant had very great possibilities for successful operation if divorced from politics and placed in the hands of an efficient governing board. This step was finally taken in 1903, the result being that today the city owns an efficient plant, a large portion of which has been paid for out of the earnings, as a result of efficient management.

On August 21, 1891, the original plant was put in operation and it ran from that date until July 3, 1911, lacking but a few days of twenty years of operation. Until 1903 the plant was in charge of a committee of the council. This committee then appointed a superintendent, who followed the dictation of the council committee. This system was naturally a means of fulfilling political indebtedness. The superintendent and employes were changed frequently and in but rare cases was any degree of efficiency secured. After many years of deplorably loose and inefficient management the machinery and transmission system became so utterly depreciated that the system was nearly worthless and the office organization, accounting methods and business management had assumed a chaotic condition which it was almost hopeless to attempt to untangle.

### The Reorganization

In the year ending 1902 the plant showed an expense of operation two and one-half times in excess of receipts. The entire equipment was out of date and in poor repair. At this juncture the people demanded a reorganization and secured it in 1903. The old committee, composed of

councilmen, was abolished and in its place a board was composed of three members, who were elected by the council, each member serving 3 years, and one new appointment being made each year. This board has been in charge continuously since 1903 and it has complete control of the plant. The present board has been in office 6 years, with a change of but one member, caused by death. This board is now composed of the following: President, M. W. Bruner, prominent lawyer; secretary, G. B. Luckett, manager of the Crawfordsville Shale Brick Company; treasurer, G. F. Huggans, retired engineering contractor.

*J. R. Thomas, General Manager Crawfordsville Electric Light & Power Co.*

### The New Superintendent

The trustees, appreciating the difficulties of attempting to rehabilitate the old plant in a manner that would place it on the efficient basis desired, employed J. R. Thomas to take charge, who is a graduate of Purdue University. He seemed better able to cope with the difficult conditions encountered than any one else. His intimate knowledge of all details, his idea of what an efficient plant should be, coupled with a high degree of engineering ability, made his services of great value. In September 1903 he was placed in charge. Mr. Thomas put the old plant in the best repair possible and advisable. However, he fully appreciated the ineffectiveness of working with worn out and antiquated equipment. He, therefore, set about making plans for a new plant that would embody the very latest practice, and contain as highly efficient equipment as possible to secure. The plans made by him were carefully considered by the trustees, together with his report of conditions as he found them at the old plant, and it was determined to secure the services of the Esterline Company, Lafayette, Ind., to work out the further details for a model plant and equipment. The building committee was composed of the board of trustees and one member of the City Council, Henry Meister.

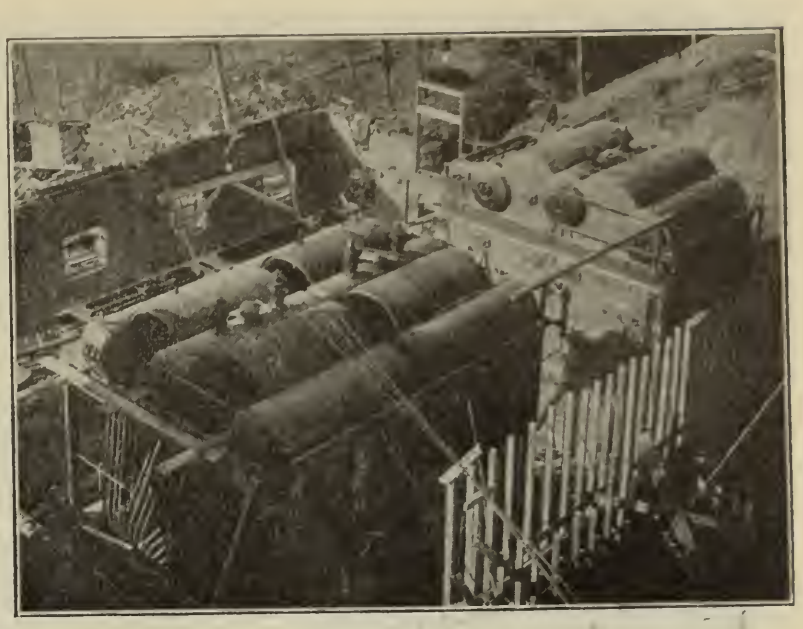
A site was selected, with several important features in mind, such as an adequate supply of water at all times, a means of handling coal and ashes that would reduce the cost to a minimum and a location that could be beautified so as to form the nucleus for a park system. The city at present does not have a public park or municipally owned civic beauty center. The latter features will be very effectively accomplished when the comprehensive plan formulated is carried out.

*Exterior View of Plant—Note Car Unloading Coal on the Bluff.*

### The New Plant

The plant is located at the foot of a high bluff and on the east bank of Sugar Creek, about three-eighths of a mile from the center of the city. On the ridge of the bluff is a switch of the Monon Railroad, over which all coal is received. The station proper is located on

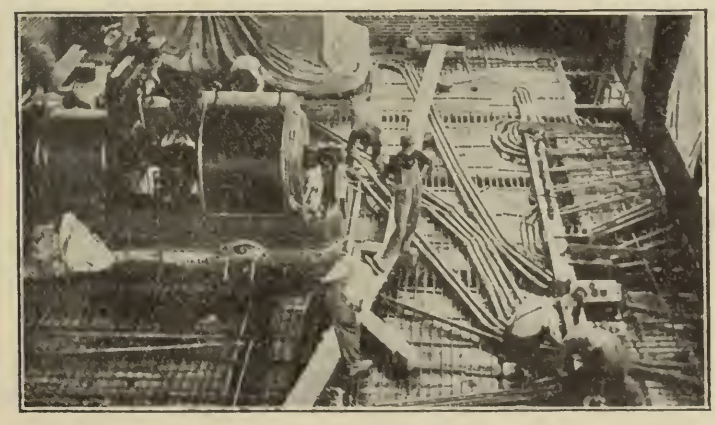
a natural ledge 65 feet below the railroad track and 20 feet above the creek. The building is of concrete, brick and steel; its plan being almost square, 71x75 feet. The boiler room occupies a space 71x40 feet and the engine room 54x34 feet. The main floor space at the end of the turbine room is divided into an engineer's office, telephone booth, shower bath, lavatories, etc. Above these rooms is a plant laboratory for carrying out tests upon the equipment. The building was designed to enable the turbine capacity to be doubled, and the boiler capacity to be increased 33 1-3 per cent, without the necessity of remodeling the plant. The excavation and concrete work was done by W. C. Carr & Son on a percentage basis. The building was also constructed by them, on contract.



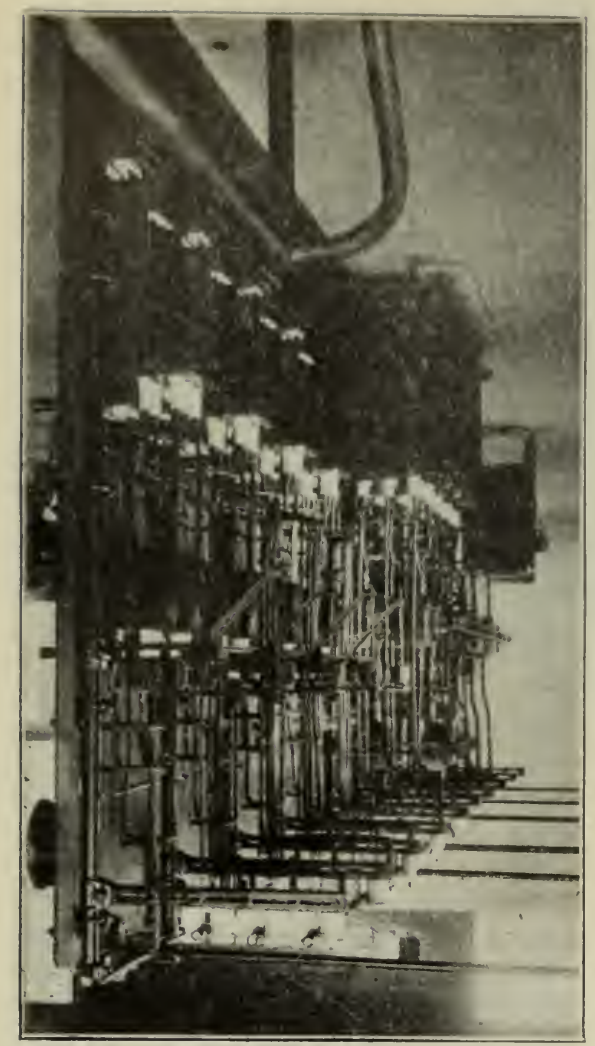
*Construction View Showing Setting of Boilers.*

In the turbine room are situated the two 25-kw. exciters, one of which is a Curtis turbine-driven generator of 3,600 r. p. m. and the other an induction motor-driven generator; two electric units of 625 k. v. a. 2,300 volt, 60 cycle, 3-phase, driven by Curtis horizontal turbines. This equipment was installed by the Ft. Wayne Electric Company. Space has been allowed for future installation of an additional 1,250-kw. turbine unit. All of the bearings of the turbines are water cooled. Turbines exhaust thru 24-inch lines into Alberger jet condensers, which are located in pits in the basement beneath the turbine room. These condensers provide 28-inch vacuum when cooling water is at 70 degrees Fahr.

The switchboard, located on the west side of the room, has been very advantageously set, four feet of clear space being allowed between the wall and the wiring, etc., thus giving ample working room. This board controls the entire electrical output and is composed of 13 panels, one of which is a swinging panel. There are 2 generator panels, 2 exciter panels, 2 feeder panels, 1 arc feeder panel, 4 rectifier panels, which are equipped for controlling four 50-lamp Westinghouse 4-amp. metallic-flame rectifiers which are located in the basement, a special feature of which enables the tubes to be operated from the switchboard; and 1 Terril voltage regulator. Aside from this equipment, the board is equipped with watt meters, ammeters, volt meters, etc., and is provided also with a synchroscope, a frequency meter and watt hour meters, for registering the consumption on arc and commercial circuits. The switchboard and eqiupment were manufactured and furnished by the Westinghouse Electric and Manufacturing Company.



*Construction View Showing Floor Reinforcement, Conduits and Wiring for Turbine Room.*



*Switchboard in Turbine Room on which is mounted complete equipment for controlling all circuits.*

The boiler room equipment consists of three 350-h. p. Stirling water tube boilers, which are fired by Roney automatic stokers. The flue gases are conducted thru a 150-foot Kellogg stack, constructed of red shale brick to the roof line of the building and thence of a radial buff brick. Internal diameter of stack is 7 feet. Provision has been made in the boiler room for an additional 350-h. p. unit. The boilers operate at 175 pounds pressure per square inch thru a 7-inch line to the main 10-inch steam header, which runs parallel with the partition wall between the boiler room and turbine room. From this header two 4½-inch steam lines supply the turbines. Extension hand wheels permit the operation of all steam valves from the floor level. Piping and valves are so arranged that any turbine can be operated from any boiler, regardless of the failure of any particular boiler unit. Water for the boilers is taken from Sugar Creek thru a 4½x3-foot concrete intake tunnel. The water is taken in thru a screen house of concrete, the wing walls of which batter in toward the bank. This construction causes a swift and deflected current which carries rubbish away from the intake rather than toward it. The intake is protected by three screens of 1-inch, ½-inch and ¼-inch, which thoroly remove all floating particles. The discharge tunnel is superimposed over the intake tunnel. In it a 3-foot baffle wall has been built which converts a portion of the tunnel into a hot well. From this well the steam-driven service pumps take their supply and deliver same to a supply tank in the boiler room over the feed water heater, from which the water flows by gravity. The final discharge of exhausted water takes place at a point in the creek about 200 feet below the intake. Just below this final discharge point is a low natural dam, which forms a pond stretching back a quarter of a mile from the intake. The water thus impounded assures an adequate supply, even during the driest periods and would serve as a cooling basin.

On the east side of the boiler house, extending up a 45-degree slope, are the concrete coal bunkers, which are 75 feet in width by 90 feet in length. Coal is supplied from dump-bottom cars, which are run in over a trestle spur at the top of the bluff, 65 feet above the floor. The coal slides by gravity to 12-inch openings and thence into the coal shutes and stokers. The floor of the bunker is a continuous 8-inch reinforced concrete slab carried on stepped pedestals which are seated on horizontal bearing surfaces in the bluff. Provision has been made for the future installation of a motor-driven coal crusher. The increase in price of slack coal and the very frequent shortage of it in this territory will make it practically imperative that such installation be made at some time in the near future in order that the plant may handle mine-run coal, if necessary, and not be dependent upon any particular size. Furthermore, if the station is forced to purchase mine run in place of slack during a time of coal shortage the crusher will effect a saving well worth while even

with the addtional expense of crushing. The capacity of the coal bunkers is 600 tons. A roof will be constructed over them in the near future. The installation of an automatic coal weigher is contemplated, to be located at the present coal opening of the bunkers.

### Results With the New Plant

The ash pit, located beneath the boilers, is 4 feet wide by 6 feet high. In the floor of this tunnel is a narrow-gage track. Ashes are dumped from the ash pit directly into the car on the track thru 18x24-inch chutes and swinging doors located on the east wall of the tunnel. The car is then run over a narrow-gage track, to various low points surrounding the plant which it is desired to fill in, being hauled out by a cable wound on a drum driven from a 3-h. p. motor. Figures for the last year show that in the handling of 6,150 tons of coal and the subsequent ashes, by means of the gravity coal bunkers and the method of handling ashes just described, there has been effected a saving of $975.

*Boiler Room, Automatic Stokers and Front End of Boilers.*

At present, one laborer handles a 24-hour load of ashes in one hour. This saving represents a return on the investment in gravity coal bunkers and ash handling apparatus of about 20 per cent annually.

The mechanical equipment of the plant is maintained in a highly efficient manner by its chief engineer, J. E. Shelley, who has been in charge for the past six years. The other employes at the plant are a night engineer, a day fireman and a night fireman, and one plant attendant.

It might be noted here that the coal consumption for last year is rather misleading, when compared with the number of kw. generated, on account of necessity of running non-condensing while installing the screen house, which took considerable time on account of high water in the creek, and also on account of the day load being small for a majority of the year.

All transmission wires leave the plant underground, coming to the surface at a point 100 feet from the plant. The current is transmitted from the plant over a No. 2 wire, and service wires in no case are less than No. 6. All wire in the overhead construction is O. K. triple braid weather proof. Manufacturers a mile and a quarter from the station are supplied with power over a No. 6 wire. The total current generated during 1912 at the plant was 1,046,432 kw. The total meter consumption for the same period was 814,321 kw. The transmission efficiency was, therefore, 77.8 per cent.

The arc lighting system is composed of

200 Westinghouse metallic-flame 4-amp. series arc lights. All wiring is overhead. The city pays the trustees a fixed amount per lamp per year on a contract, as would be done in event the lighting plant were a privately owned company. The charge for lighting is $66 per arc lamp per year. An interesting fact in regard to the number of lights in Crawfordsville is that this city maintains more arc lights for street lighting purposes per capita than any other city in Indiana with a population from 9,000 to 20,000.

### The New Reduced Rates

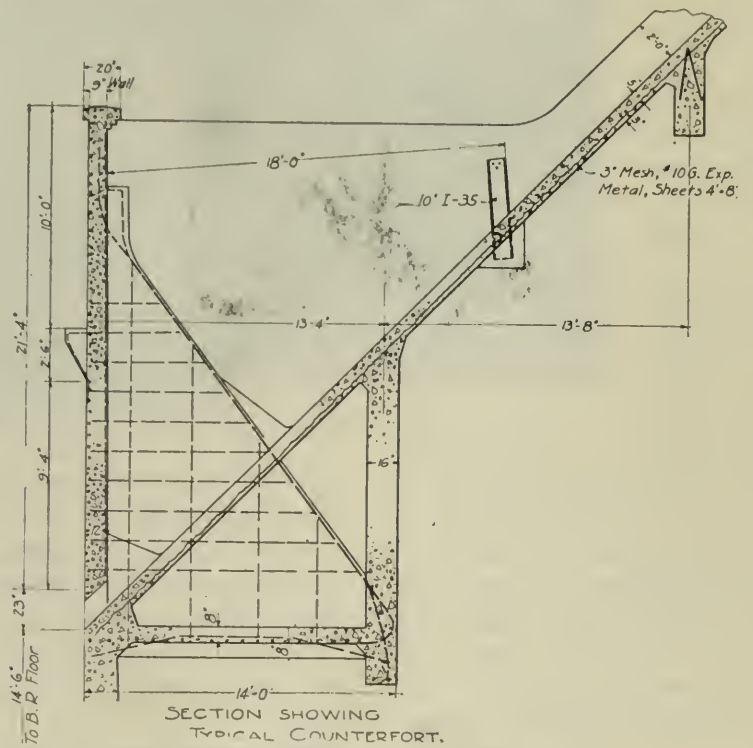
The commercial lighting rates at present are 10 cents per kw. hr. for first 100 kw.; 6 cents for next 200 kw. and for all over 300 kw., 4 cents. Consumers are allowed a 10 per cent discount on their bills when paid before the 10th of the month. This commercial lighting rate applies to every class of consumers using lights, whether for residential, church or factory lighting purposes.

The rates for power as as follows:

| | | |
|---|---|---|
| First 100 kw | 4 | cents |
| Next 400 kw | 3½ | cents |
| Next 500 kw | 3 | cents |
| Next 1,000 kw | 2½ | cents |
| Next 5,000 kw | 2 | cents |
| Next 5,000 kw | 1¾ | cents |
| Next 10,000 kw | 1½ | cents |
| Next 10,000 kw | 1 | cent |

Where residential consumers install heating devices, such as stoves, heaters, etc., and current consumption is sufficient to warrant separate meter, they are allowed power rates. Power rates also apply on signs and building outlines. In addition to the above rates a "readiness-to-serve" charge is made as follows: 50 cents per h. p. up to and including 10 h. p.; all over 10 h. p., 25 cents per h. p. per month. This is a fixed charge against the consumer, whether any current is used or not.

The above rates were put into effect September 1, 1911. As compared with the rates prior to this date in the case of small consumers this was a reduction of 44 per cent and in the case of the largest consumers was a reduction of 20 per cent. The lowering of the rates at this time was found practical because of the large savings effected by the new plant, which started operation the same year. This reduction is the first step on the part of the management to furnish consumers with power at as low cost as possible, after making all necessary charges.




*Sectional View of Coal Bunker.*

### The Results of Last Year's Operation

At the time the trustees took up the management of the plant in 1903 there were 430 consumers on the books. The

total revenue during the year 1902 was $8,351.91, the total expense for the same year was $20,801.51, not including merchandise. At the close of the year 1912 there were 1,378 consumers; the total revenue for that year was $50,578.53, not including merchandise. The total operating cost during the same period was $26,-084.33, consisting of the following items:

| | |
|---|---|
| Pay. roll | $13,263.14 |
| Coal and oil | 8,475.60 |
| Repairs on line plant, etc | 1,025.33 |
| Carbons | 72.92 |
| Insurance | 135.20 |
| Other operating expenses | 3,112.34 |
| Total | $26,084.53 |

In addition to above there were disbursements for year ending December 31, 1912, for improvements, bonds, interest, etc., $21,902.97; total disbursements, not including merchandise, $47,987.50; cash on hand December 31, 1912, $2,591.03; total, $50,578.53.

### The Profits Thus Far

Prior to the action of the council in voting definitely upon appropriation for the new plant, the trustees agreed to furnish $35,000 of the amount necessary to finance the proposed plant. This sum was made up of a sinking fund containing $25,000, which had been established thru the successful management of the old plant; $10,-000 then in a surplus fund also secured thru successful management and in the hands of the trustees. The council agreed to the raising of $73,000 by a bond issue. The appropriation for the new plant was, therefore, set at $108,000. When the new plant was completed the actual cost reached $119,342.28. Instead of paying $35,000 as originally proposed by the trustees, they actually paid out $52,924.30. Of this last amount $6,582.02 was paid to the city for the retirement of bonds. Therefore, the remaining bonded indebtedness to be met by the lighting plant from its profits is $66,417.98.

Mr. Thomas is now working out a schedule of depreciation charges that will amply cover actual depreciation due to natural wear and tear, and also of all equipment and depreciation due to progress, as well as creating a fund for extension and improvements. This burden will be charged against the plant in the very near future, and rates will not be further lowered until such time as it is demonstrated beyond all question of doubt that the plant is capable of earnings in excess of every necessary charge to keep it at a maximum of efficiency and in a thoroly modern condition.

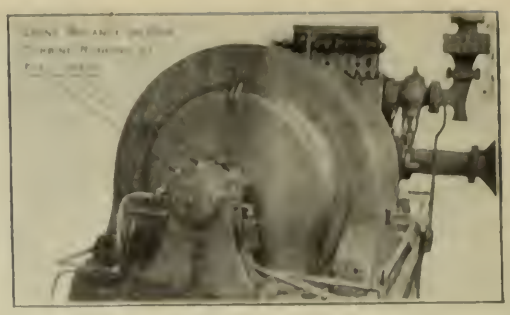
### The People Are Satisfied

That the people of Crawfordsville are thoroly satisfied with the service they are receiving is demonstrated on every side. Not only are they loud in their praises of the service they are receiving, both as to cost and quality, but they have further demonstrated their approval by their support. The average annual increase in number of consumers since 1903, when the board of trustees took charge, has been 22 per cent. The average yearly increase in population for this city for the ten years prior to 1910 was 4½ per cent. The revenue from power has increased over 100 per cent for the period from January, 1911, to January, 1912. The increase in revenue from commercial

*Coal Bunkers under construction.*

*Coal Bunkers after completion.*

*Skidding Turbines from Railroad to Plant.*



*Curtis General Electric Turbine.*

lighting for 1912 over 1911 was over 7 per cent, notwithstanding the reduction in rates of from 20 to 44 per cent in the same year.

### Non-Political Municipal Ownership a Success

The figures and description presented here show quite emphatically that a municipally owned plant, under the direction of a competent executive board, which has been removed from politics as far as possible, and placed in the hands of a thoroly competent general manager, similar to those employed by privately owned public utility companies, a degree of success can be secured that compares very favorably with that of private public utilities. The matter of rates is vested in representatives of the taxpayers and if these representatives do not have political "axes to grind," and are assured of a continuance of office based upon an efficient conduct of the affairs placed in their hands, the people are then practically guaranteed a protection of their interests, rates that are fair and equitable, and the right of appeal and hearings as taxpayers, without the barriers that franchise grants impose upon them.

# INCREASED DRAINAGE CANAL DIVERSION REFUSED.

The application of the Chicago Sanitary district to divert 10,000 cubic feet of water per second instead of the 4,167 cubic feet now authorized has been denied by Secretary of War Stimson. This will interfere very seriously with the plans of the sanitary district for the drainage and sewerage of large areas in the city and the southern districts into which the city is rapidly extending.

The reasons given for the denial of the petition are given as follows:

That the diversion of 10,000 cubic feet per second from Lake Michigan, as applied for in this petition, would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers.

That being so, it would not be appropriate, without express congressional sanction, to permit such a diversion, however clearly demanded by the local interests of the sanitation of Chicago.

That on the facts here presented no such case of local permanent necessity is made evident.

That the provisions of the Canadian treaty for a settlement by joint commission of "questions or matters of difference" between the United States and Canada offer a further reason why no administrative officer should authorize a further diversion of water, manifestly so injurious to Canada, against Canadian protest.

Chicago will, doubtless, make strenuous efforts to secure a reversal of this decision, for, otherwise, the city must prepare to purify the sewage of the new districts and some from older districts before discharging it into the lake, the streams flowing into the lake or the drainage canal itself.

# Park Drives and Boulevards.

*By Linn White Chief Engineer, South Park Commissioners, Chicago, Ill.*

Park driveways in this article are taken to include all public routes of travel on which the character of traffic is restricted, and are thus distinguished from streets and highways on which traffic of all kinds moves unrestricted. The term includes what are, in many cities, called boulevards, which may be parts of a system of streets through populous districts of a city, or may partake of the nature of a suburban highway.

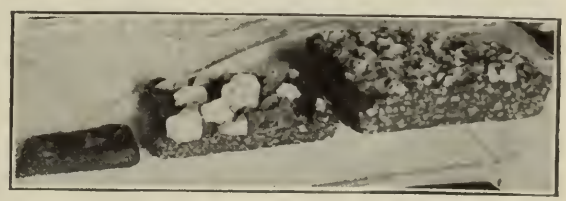
Usually what is termed heavy traffic or teaming traffic is excluded from roads of this character. This establishes a class of fast moving, generally light vehicles traveling over boulevards and park driveways and limits the character of surfaces to those best adapted to this kind of traffic. The surface of such roads must be smooth, but not slippery; firm, but not hard; stable, but with a measure of rubber resiliency; should withstand a wide range of temperature variation without injury; be free from dust; easily cleaned and without an unpleasant glare in sunlight. Also the roadway must be of ample width, the crown not too high, drainage carefully provided and catch basins or sewer inlets placed at frequent intervals.

The character of traffic over such roads is of the highest class in the community and the standard of road excellence is continually being made higher. On a road thru a park, formality should generally be dispensed with. Grades should be laid to cling close to the surface of the ground, the alignment should be with easy, natural curvature, not forced and meaningless, but leading with fair directness to the objective point.

## Intense Traffic in Chicago

In the improvement of boulevards and city park driveways, the amount as well as character of traffic should determine the kind of paving surface. The words commonly used to describe traffic are "light" and "heavy," but the terms are ambiguous as *light* may mean light weight vehicles or few in number; *heavy* may mean heavily loaded of great in numbers. The use of such terms as "intense" should better describe a condition of traffic that exists on many park roads than either "light" or "heavy," meaning a great many comparatively light weight rapidly moving vehicles. Such a condition is found on the Chicago boulevards and it is rapidly growing more intense.

A bituminous pavement has more of the desirable qualities for a boulevard or park road pavement, but unless properly



*Cross Sections.*
*No. 1.* *No. 2.* *No. 3.*

constructed in all respects may prove a disappointment under intense traffic. If the pavement is lacking in lateral stability under high temperature or is not properly supported by the base the effect of rapidly moving vehicles is to form parallel grooves or ruts which when once started grow worse, because each following vehicle tracks in the same rut the preceding one started.

### Asphaltic Pavement

Many of the boulevards and park roads of the South Park district during the last three years have been laid with what is termed mineral rubber pavement. This is a pavement that has become fairly well known in many sections of the country by frequent descriptions and because of its acknowledged success and low cost. The mortar is similar in composition and proportions to a sheet asphalt surface mixture. The proportions of broken stone in the mixture may be varied according to circumstances. When it fills a very considerable proportion of the mass, it aids in making a stable, non-shifting surface. The base should have a rough surface, not completely filled with fine materials, so that it will completely interlock itself with the top surface. This is best done on macadam by light rolling and on concrete by tamping, while, in both cases, the foundation is still soft.

### Cross Section Views

The illustration shows sections of this pavement which have been under traffic and which have been sawn thru to show the structure.

Section No. 1 is a scant inch thick and has been under traffic for four years with no repairs. This section was lifted from a block on Grand boulevard, also shown in this article, one of the first boulevards laid with this paving in Chicago. It has been subjected to intense traffic during the past four years and it behavior has been exceedingly exemplary since, as before stated, it has not required repairs of any kind and to date has not shown the slightest defect or sign of movement. Section No. 2 is about 1 inch thick and has a number of stones of the base adhering, which were lifted with it and sawed thru to illustrate the complete structure. All of these samples were photographed with the wearing surface down. In order to illustrate the intense traffic to which Section No. 1 has been subjected, I quote from our report of April 10, 1911, and it is but fair to state that the traffic at these two points on

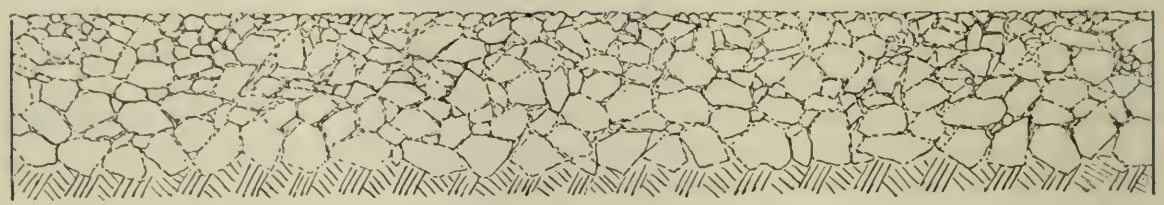


Fig. 1.

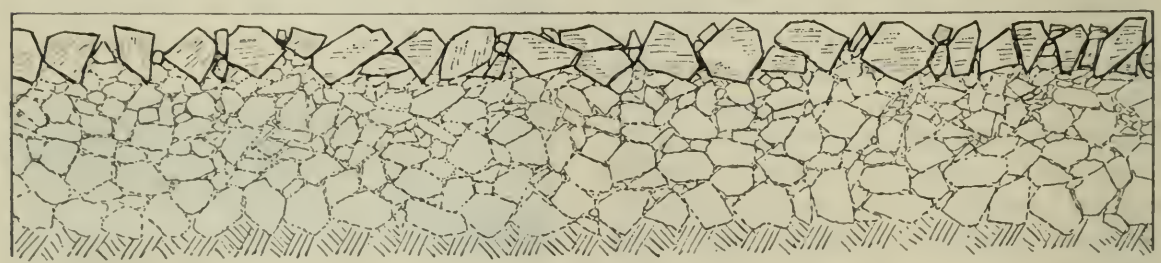


Fig. 2.

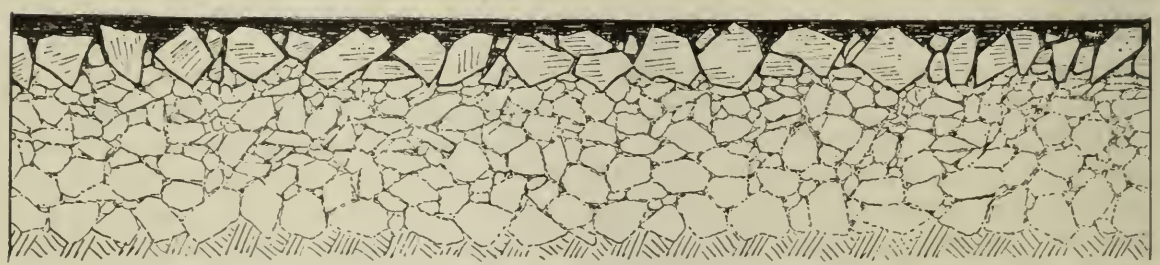


Fig. 3.

*Fig. 1. First Course, Macadam Base.*
*Fig. 2. Second Course, Layer of Coarse Stone.*
*Fig. 3. Third Course, Mixed Bituminous Wearing Surface Rolled Into Intermediate Layer of Coarse Stone, Forming the Complete Pavement.*

Grand boulevard has increased fully 33 1-3 per cent during 1912:

which may be moved over an ordinary road without dismantling in any respect.

| Location | Date | 6 P. M. to 6 A. M. Automobiles | 6 P. M. to 6 A. M. Horse Vehicles | 6 P. M. to 6 A. M. M. Cycle, etc. | 6 A. M. to 6 P. M. Automobiles | 6 A. M. to 6 P. M. Horse Vehicles | 6 A. M. to 6 P. M. M. Cycle, etc. |
|---|---|---|---|---|---|---|---|
| Grand Boul. and 38th Street | 3-13-11 | 1156 | 120 | 78 | 2311 | 221 | 216 |
| Grand Boul. and 51st Street | 3-14-11 | 1078 | 58 | 109 | 1320 | 118 | 178 |

| | Greatest Number in One Hour Automobiles | Horse Vehicles | M. Cycles, etc. | Total All Kinds | Total for 24 hours |
|---|---|---|---|---|---|
| Grand Boul. and 38th Street | 5 to 6 P. M. 260 | 2 to 3 P. M. 50 | 12 to 1 P. M. 42 | 384 | 4102-2 |
| Grand Boul. and 51st Street | 8 to 9 P. M. 251 | 3 to 4 P. M. 24 | 5 to 6 P. M. 34 | 282 | 2861-9 |

Our experience has shown that this style of pavement fills the requirements of Chicago's intense traffic streets and that it is moderate in cost, easy to repair and thoroly waterproof. It has a smooth, sanitary surface of an agreeable dark color free from glare and is of uniform consistency under a wide range of temperature. It is elastic in that should the foundation prove somewhat weak, it can be depended upon to adjust itself to the conditions, always remaining an elastic, non-slipping, non-absorbent, non-dust and non-noise producing pavement.

### The Asphaltic Mixing Plant

We have adopted Twentieth Century portable asphalt plants for producing these pavements. They are complete asphalt plants mounted on one truck and To move the plant is it only necessary to throw the belt off the driving pulley and attach a roller or traction engine. In these plants the heating and drying of the stone and sand is done by forced draft, the asphalt is heated by the same fire that heats the sand, and the mixing is done in a regular type of asphalt mixer not exposed to the direct heat of the fire. The daily capacity of each of these plants is rated at 1,000 square yards of pavement 2 inches thick, but the record is that frequently 1,250 square yards or more 2 inches thick, and 1,700 square yards 1½ inches thick have been laid with each plant. Four of these plants are in use in the Chicago park systems and about a million and a quarter square yards of pavement have been laid with them during the last four years.

*Grading and Rolling Crushed Stone.*

*Asphalt Plant in Operation.*

### Plant Foreman's Report

Our method of recording costs and results of daily work of asphalt plant crews may be of interest. The daily report of the asphalt plant foreman, records:

1. Date.
2. Work number.
3. Location of work.
4. Total batches delivered by each asphalt plant.
5. Hours delay and cause.
6. Number and duties of each man employed.
7. Number of hours and rate per hour of each man.
8. Amount of asphalt used.
9. Amount and kinds of stone used.
10. Amount and kinds of sand used.
11. Amount of coal used.
12. Amount of gasoline used.

In order to illustrate the data as to number, rate and hours of men employed in the asphalt plant crew, I quote from the asphalt plant foreman's report on work order No. 2201 of July 1, 1912, as follows:

| Number of men. | How occupied. | Rate. | Hours. |
|---|---|---|---|
| 1 | General construction foreman | 55 5/9 | 1 |
| 1 | Asphalt plant foreman | 33 1/3 | 9 |
| 1 | Traction engineer | 55 1/2 | 12 |
| 2 | Firemen | 29 2/3 | 18 |
| 4 | Asphalt cutters | 25 | 36 |
| 4 | Tankmen | 25 | 36 |
| 6 | Feeders | 25 | 54 |
| 4 | Mixers | 25 | 126 |
| 2 | Coal men | 25 | 18 |
| 6 | Men cleaning up | 21 7/8 | 54 |
| 4 | Linemen | 25 | 36 |
| 1 | Oiler—Machine tender | 30 | 12 |
| 4 | Carts hauling hot asphalt | 50 | 24 |
| 4 | Carts moving material | 50 | 12 |
| 1 | Team cleaning up | 68 3/4 | 9 |
| 1 | Timekeeper | 33 1/3 | 2 |
| 2 | Timekeepers | 27 1/8 | 4 |
| 2 | Watchmen | 25 | 18 |
| 1 | Water boy | 12 1/2 | 8 |

### The Surface Crew

The surface foreman's report on work order No. 2201 of the same date records:

1. Date.
2. Work number.
3. Location of work.
4. Thickness of asphaltic concrete laid.
5. Square yards of each thickness.
6. Number and duties of each man employed.
7. Number of hours and rate per hour of each man.
8. Total batches received from each asphalt plant.
9. Number gallons for squeegee.
10. Number cubic yards and kind of sand.
11. Number pounds of coal.

The surface foreman's report on work order No. 2201 of the same date also records:

*Placing and Rolling Wearing Surface.*

| Number of men. | How occupied. | Hours. | Rate. |
|---|---|---|---|
| 1 | Top foreman | 40 | 9 |
| 4 | Laborers raking | 38 | 42 |
| 1 | Laborer tamping back | 38 | 10 1/2 |
| 2 | Laborers tamping | 32 | 21 |
| 4 | Laborers spreading | 27 | 42 |
| 1 | Laborer dumping carts | 27 | 11 1/2 |
| 1 | Laborer painting joints | 27 | 11 1/2 |
| 1 | Laborer spreading sand | 25 | 10 |
| 1 | Timekeeper | 27 1/2 | 2 |
| 2 | Ten-ton rollers | 55 1/2 | 21 1/2 |
| 1 | General foreman | 55 5/9 | 1 |

### Square Yards Laid

The daily reports of the plant and surface foreman show at a glance the number of batches and square yards laid each day. The following information on work order No. 2201, July 1st to July 5th inclusive, is also obtained by speedy compilation from plant and surface foremen's reports:

| Date. | No. batches Plant No. 1. | No. batches Plant No. 2. | Square yards 1½-in. asphaltic concrete laid. | Square yards 2-in. asphaltic concrete laid. | Hours' delay Plant No. 1. | Cause. | Hours' delay Plant No. 2. | Cause. |
|---|---|---|---|---|---|---|---|---|
| July 1-12 | 126 | 100 | 1453.1 | 70.3 | | | | |
| | | | | | | | 3 | Changing mix. |
| July 2-12 | 155 | 136 | 1858.6 | .... | | | 4 | Moving materials |
| | | | | | | Moving materials. | | Moving materials. |
| | | | | | 2 | Repairing grade. | | Repairing grade. |
| July 3-12 | 182 | 212 | 2417.4 | .... | 1 | Repairing grade. | | |
| July 5-12 | 161 | 165 | 1837.2 | .... | 1 | Moving plant. | | |

### The Proper Setting

Constructed and maintained as they should be, with the high-class traffic they carry, park roads and boulevards must have the proper setting and accessories. On a boulevard, with building on either side, the lines and setting should be formal. The bordering trees should be in rows evenly spaced, there should be a substantial stone or concrete curb, the parkways on either side of regular width, and, in keeping with the general formality of the scheme, the alignment of the roadway should be straight, unless local conditions require curves.

If the contour of the land does not suggest or compel reasonable curvature, let the road wind around clumps of trees, as if avoiding the necessity of cutting them out, and mask the turns with clumps of shrubbery, as much as may be consistent

with safe driving, so there may be some variety and surprise in the landscape beyond. These matters may be encroaching somewhat upon the profession of landscape architecture, but an engineer to be entrusted with the planning or laying out of park roads must be somewhat of a landscape architect, or, to put it more accurately, he must be a lanscape engineer.

In park roads, using the term in its strict meaning, formal curbs should be dispensed with, catch basins should be generally of the sewer inlet type without settling basins, and castings for sewer inlet covers should be combination gutter grates and side inlets. This style of sewer casting is less conspicuous than the usual side inlet type with solid iron cover. The grating in the gutter may be lifted to give access to the basin and the side inlet provides an overflow in case the grating is choked with leaves. The lamp posts should be less obtrusive, less in evidence, than is permissible on boulevards. Their frequency will be according to necessity in each case, but generally lighting is not required to be as thoro as on boulevards.

A character and distinction is given the park road by judicious use of statuary and vases for flowers, as well as the proximity of walls, flights of steps and buildings. These are human touches of the roadside which give a pleasant sense of use and contrast with nature. Other roads that as in the old riddle "go up hill and down hill, yet always stand still," may satisfy the necessities only of transportation, but the park road should suggest time to enjoy surroundings. A seat well placed in a shady nook or a bridge over a quiet stretch of water is an invitation to linger awhile which is the proper function of a park roadside. Too many roadside statues, vases, balustrades, etc., suggest the architecture of formal gardening rather than the restrained naturalness proper in park landscape.

*Asphaltic Pavement, Grand Boulevard, Chicago, Ill.*

The latter two or three sentences are particularly applicable to what may be termed city parks with roads properly belonging to such semi-formal parks. There is another class of parks, often established near cities, belonging more to the free, open country where the roads must be simply improved to be in keeping with the rural character of other improvements.

There are, therefore, in the light of what has been said, three grades of park roads, which may be classed as boulevards, city park roads and suburban park

roads. Not every town or city interested in park development may recognize this exact division, but the natural tendency is towards it.

*Summary of asphaltic concrete paving done by South Park commissioners with the portable asphaltic paving plants during the season of 1911:*

| | Sq. Yds. |
|---|---|
| Jackson Boulevard | 9,500 |
| Michigan Avenue | 19,045 |
| Jackson Park, Harbor Drive | 14,461 |
| Grand Boulevard | 21,280 |
| Garfield Boulevard | 28,428 |
| Western Avenue | 19,143 |
| Washington Park, walks in vicinity of Administration Building | 6,406 |
| Washington Park, 57th St. driveway entrance | 2,096 |
| Drexel Boulevard | 3,782 |
| Hamilton Park, Tennis Courts | 4,017 |
| Repairing openings in pavements made under permits | 3,046 |
| Miscellaneous repairs and other small items charged to maintenance | 2,551 |
| Total for 1911 | 133,755 |

*Summary of asphaltic concrete paving done by South Park commissioners with the portable asphaltic paving plants during the season of 1912:*

| | Sq. Yds. |
|---|---|
| Washington Park, East Drive | 27,400 |
| Drexel Boulevard | 11,500 |
| Jackson Park, Middle Drive | 8,500 |
| Michigan Avenue | 7,825 |
| Grand Boulevard | 22,738 |
| Garfield Boulevard | 19,900 |
| Sherman Park | 4,863 |
| Western Avenue | 4,625 |
| Miscellaneous repairs and other small items charged to maintenance (est.) | 3,200 |
| Repairing openings in pavements made under permits (est.) | 2,500 |
| Total for 1912 | 113,051 |

*Portable Asphalt Plant Used by Park Commission.*

# Prevention of Defects in Brick Pavements.

THE careful study of the expansion and contraction of brick pavements made by James E. Howard of the United States Bureau of Standards, the methods of which were explained in an article in the December number of MUNICIPAL ENGINEERING, has shown the reasons for a number of the minor defects which develop in brick pavements, and has given suggestions of lines in which to direct the investigation of the causes of others. Some of these defects are shown in the accompanying photographs, for most of which we are indebted to Mr. Howard.

The discussions of these defects are based on Mr. Howard's expressions of his opinion, but do not always agree fully with them.

### Transverse Cracks

The transverse cracks shown in Fig. 1 (in heading of article), appeared in Andrews avenue, Lakewood, O., before the street was thrown open to traffic. Mr. Howard reports a progressive development in these early transverse cracks from fine hair lines to widths even greater than that shown, and that they appear in pavements having the expansion joint next the curb, as well as in pavements like the one shown, in which there is no such longitudinal expansion joint. He attributes the crack in the pavement to the expansion and contraction of the curbstones, the friction of the stones on the brick causing the latter to follow. It is probable that this friction tends to locate the crack in the pavement in the joint nearest the joint in the curb, but the form and width of the crack shown in Fig. 1, as well as the cracks observed in other parts of the pavement, show that the brick pavement also expands and contracts without reference to the curb and that cracks in the pavement are generally independent. The transverse cracks shown in Fig. 2 are further evidence of this. This pavement, on East Sixty-sixth street in Cleveland, O., is older and the cracks are more pronounced.

### Lengthening of Pavement

The pavement lengthens as a whole. Andrews avenue in ten months' time had extended in both directions, at one end crowding five-eighth of an inch over the marginal curb at a railroad crossing, and at the other crowding the asphalt pavement on the intersection of a cross street and carrying the street car tracks with it.

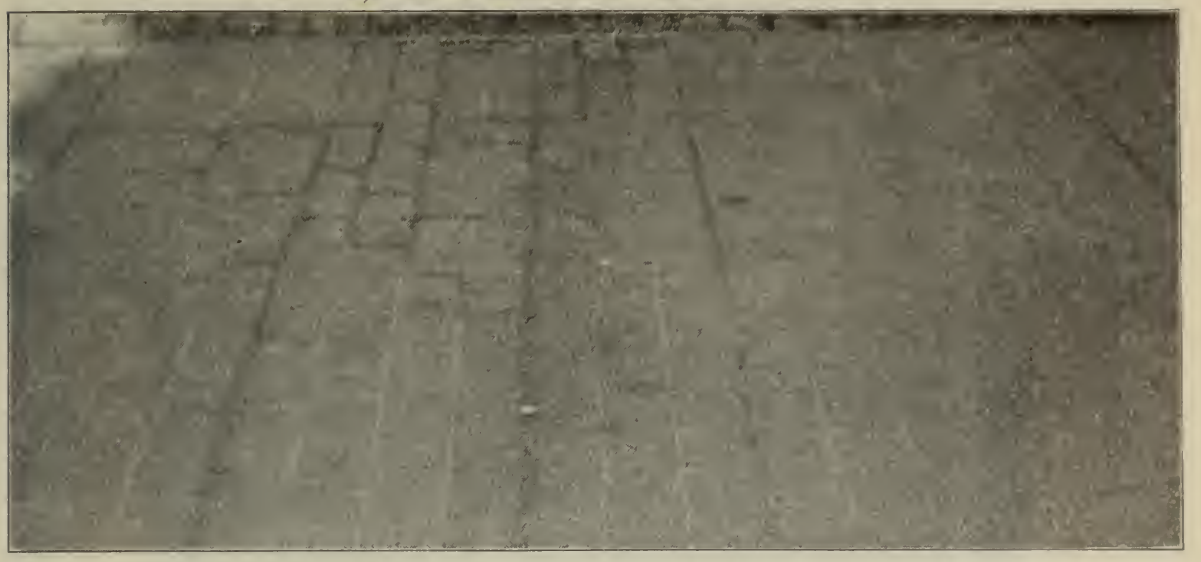
Farmington road, East Cleveland, paved about August 1, 1911, was observed during September, October and November and showed extension in the 20-inch length measured from September 22, to September 30, of 0.0080 inch; to October 23, of 0.0170 inch; to November 9, of 0.0250 inch, and to November 13, of 0.0377 inch. The temperature on September 22 was about 90 and on November 13 was 32 degrees. In August, 1912, with a temperature of 82 degrees, the crack was very much reduced in width.

### Widening of Cracks

A cement filled brick street is intended to be a monolith with the adhesion of the cement to the brick as nearly equal in strength as possible to the cohesive strength of the bricks and of the cement in the joints. Cracks appear upon the contraction of a pavement on account of cold, because the bond between the cement in the joints and the brick is broken, or

because the cement joint has not attained its full strength. The opening of the joint increases with the decrease in temperature, the amount of the opening, as given above, being due to the contraction of the masses of brick on each side of the crack, which are still monolithic and so act as two units. The amount of opening at any one crack also depends upon the possibility of motion of the monolithic masses upon the sand cushion. One crack may not open because there is a tendency for the mass to remain fixed at that end, and the crack at the other end opens because the mass contracts away from it. Other things being equal the masses tend to contract toward their fixed centers and the openings of the cracks are proportional roughly to the drop in temperature.

Grade, resistance at ends of the stretch of pavement, even form of bearing of brick on sand cushion, give tendencies for greater motion in one direction than in another, so that creeping of pavements is frequently observed. Andrews avenue, as noted above, expanded in both directions. Belmore road, near Euclid avenue, East Cleveland, moved nearly 4 inches at the point shown in Fig. 3, shearing off the catch-basin grating. All engineers are familiar with examples of this sort.



2. *Transverse Cracks in East Sixty-sixth Street, Cleveland, after several years of development.*

### Contraction Joints

If the pavement as laid is truly monolithic and a plane and remains so, and if it could be laid during a period of uniform temperature long enough to enable the mass to set completely, the monolith would have no temperature stresses in it. If, now,

3. *Catch basin grating, Belmore road, near Euclid Avenue, East Cleveland, O., sheared by creeping of pavement and moved nearly three inches.*

the temperature rises, an internal compressive stress is developed. If the pavement is a plane surface and the ends and sides are rigidly held, this stress increases with the temperature and with sufficient increase in heat might ultimately become great enough to crush the brick or the cement joints or cause the pavement to bulge in some place where the direction of the stress was changed by defective construction or material. The greater heat on the surface of the bricks causes greater stress in the upper part of the pavement and thus insures a tendency to bulge. The temperature stress is seldom, if ever, sufficient to crush the brick, unless the stress is concentrated on a single line, as was probably the case in the spalled joints next to the creosoted wood block "contraction joint" shown in Fig. 4, from East Thirty-second street, Cleveland, O. This wooden block course is not an expansion joint because the blocks do not permit sufficient compression to act as such, but are rather joints to locate transverse cracks due to contraction. The pavements in which they are used should be laid at high temperatures, or at least the wooden block should be inserted when the temperature is high. The difference in material presents a variation, the result of which it is difficult to predict. The wooden course does not confine the pavement rigidly and yet it does not permit it to expand. It does not wear uniformly with the brick and so presents an area of weakness. Its only value is in breaking the monolith into sections short enough to insure that contraction cracks will not occur between the wooden courses, thus locating all such cracks at predetermined places.

If the temperature falls below that at which the pavement was laid, the internal stress is one of tension and there is a tendency to pull the monolith apart. Defective filling of the joints with cement grout, or disturbance of the pavement by use or by considerable change in temperature before the cement has fully set will cause separation at the defective joints, but cement filler properly put in will withstand the ordinary reductions in temperature to which a brick pavement is subjected.

4. *Spalled Courses in East Thirty-second Street, Cleveland, O., adjacent to course of creosoted wood blocks, which may serve as a "contraction joint," but fails to allow expansion or to confine the pavement rigidly.*

### Temperature to Lay a Pavement

*It is evident that the proper temperature at which to lay a pavement is one somewhere near the mean of the ordinary extremes to which it is subject, say, 10 below zero and 130 above in the central latitude of the United States. Pavements laid in temperatures above this average will be subject to some troubles, which those laid at lower temperatures are free from, and the reverse. In any particular case the range in temperatures at time*

5. *Upheaval of crowned sidewalk crossing on Ravine Avenue, Cleveland, O., by expansion of pavement each side of it.*

*of laying is considerable and a reasonable variation above and below, say, 60 degrees must be expected.*

If the ends of the pavement are not rigidly held, there will be the creeping already mentioned and shown. Street intersections will usually show the effect of this expansion, because there are changes in the surface due to the crowns of the intersecting streets. The expanding blocks of pavement on either side of the intersection will crowd these crowned areas and the result is the lift of the summit of the crown shown in Fig. 5, from Ravine avenue, Cleveland.

### A Perfect Pavement

The perfect surface of South Sixth street, Terre Haute, Ind., Fig. 6, laid in 1891 and 1892, shows the advantage of perfect construction at average temperatures, but the street intersections were unable to withstand the expansion of the blocks between and they buckled and even exploded where the crowning of the cross streets gave an opportunity for upward movement under the horizontal pressure due to the expansion.

Cracks formed by the pulling apart of the bricks will catch the street dirt, and if the pavement under increase of temperature tends to close the cracks it cannot do so completely. This emphasizes the tendency to creep, and, therefore, increases the width of the cracks with each change of seasons.

Mr. Howard reports that one section of Kennedy avenue, Cleveland, was laid with a tar filler and a section at each end of it with cement filler. One of the cement-filled sections is traveling up hill toward the tar-filled section and is compressing the end of that section. The other cement-filled section is traveling down hill with the same result. The bricks of the tar-filled section act as individual units, however, so that this compression is taken up by the tar-filled joints and the compression shows for but a short distance. The amount in 20 inches of measured section was 0.1155 inches near one end and 0.1968 near the other, between September 29, 1911, and August 25, 1912.

### Effect of Curves in Street

The cracks shown in Fig. 7 in a reversed curve of Cummington road, East Cleveland, O., are due to the shearing

6. *South Sixth Street, Terre Haute, Ind., has a perfect surface after twenty-one years of wear.*

action of the straight stretches of pavement at each end, which have expanded and broken the bond of the brick where the change in crown curve positions gives opportunity for enough motion to pull them apart. The openings left between the pavement and the inner curb were 1½ and 2 inches. An opening between cement curb and gutter on the inside edge of a curve is produced by the pressure of the expansion separating the pavement from the gutter by the creeping of the former. The pavement is sometimes forced into the gutter on the outside of the curve enough to break curb and gutter.

7. *Fractures in pavement of Cummington Road, East Cleveland, O., on reversed curve, from expansion of straight pavement at each end.*

### Longitudinal Cracks

There is a similar expansion of the brick pavement transversely. The ordinary street pavement has a crown so that the condition is changed from the straight-line effect of the longitudinal expansion and contraction. First, if the sides of the pavement are confined, expansion will tend to raise the pavement off the sand cushions, the arch having an opportunity to become longer. If this elevation of the crown of the arch is sufficient, a longitudinal crack occurs at or near the crown. Second, if the sides of the pavement are not confined, any creeping which may develop from alternate expansions and contractions will tend down the slopes of the crown toward the gutter and the strain set up in the pavement will result in a more or less regular longitudinal crack following the lines of least strength, with a tendency to remain near the crown of the arch. The cracks shown in Fig. 8 and 9 are of the nature of these two classes. Those in Fig. 8 are in West Fourteenth street, Cleveland, and have the appearance of bending under compression caused by expansion or settlement of rails under the weight of cars. That in Fig. 9 is in Kennedy avenue, Cleveland, and may be due to contraction. Another common cause for cracks in brick pavements in the more northern cities is bulging due to freezing of a wet sub-soil, but this should not be possible in a pavement with well-filled joints on proper foundation, drained by a sewer trench, as most paved city streets are.

8. *Longitudinal cracks between rails and trolley tracks on West Fourteenth Street, Cleveland, O., due to transverse bending from expansion of pavement or expansion of rails.*

Fig. 10 shows other effects of transverse expansion. If the expansion joint next the curb is not wide enough or resilient enough, or there is none, as in the case of South Sixth street, Terre Haute, the transverse expansion of the brick pavement shoves the curb back and, when the curb is backed up by a sidewalk, the curb is pushed back under the sidewalk and broken off. Expansion of the sidewalk may aid in this process.

The heavy catch-basin construction at the corners held itself in position and the brick pavement itself was obliged to give way, some of the effects of which show in the picture. The effect was still greater out toward the center of the intersection, where excessive bulging took place and the pavement had to be relaid.

### Expansion Joints

The specifications used in some cities call for expansion joints across the streets

10. *Breaking of curb on South Sixth Street, Terre Haute, Ind., by expansion of pavement. Heavier construction of catch basin keeps it in position.*

at each intersection and around the manholes and catchbasins. This is a concession to the change in form of surface due to the crowning of the cross street and does not deny the fact that a brick pavement laid at the mean or higher temperature is in more stable condition, will carry traffic better and will be less liable to cracks, spalling and crushing of joints, if it is rigidly confined at both ends. The same would be true of the sides of the pavement if it were a plane surface instead of curved. A condition of compressive stress is safer than one of tensile stress, because shocks upon the

9. *Longitudinal Crack in Kennedy Avenue, Clevelond, O., probably due to expansion of pavement raising the crown.*

former can have little or no effect, whereas the factor of safety for tensile strength is less than that for compressive strength, and, therefore, a shock to a pavement under heavy tensile stress is more liable to result in a crack.

Transverse cracks in a pavement increase in width also by abrasion of the edges of the brick. Each solid section of pavement acts independently and any condition allowing motion, such as arching under compression, soft foundation, and the like, presents one edge of the crack or the other to direct blows of traffic, which are bound to knock off the unsupported edges and then to hammer the resultant lower surface until it is gradually or rapidly disintegrated.

### Street Railway Tracks

The difficulties with street railway tracks are so well known that they need not be discussed here. In the early paving days they were accepted as a necessary evil and the first attempts at rigid construction under the tracks were resented as confiscatory expense. But experience has shown that the expense is fully justified in the saving of repair on the pavement surfaces.

# An Artistic Stone Arch.

By Henry B. Seamon, Member Brooklyn Engineers' Club.

WILE in the employ of the N. Y., N. H. & H. R. R., some years ago, the writer was called upon to construct a stone masonry arch at Pelhamville (now Pelham), N. Y., which would carry a four-track railroad, and yet conform to the proposed development of the property in this vicinity, which was to be that of a residential park.

The form of arch usually selected for this purpose was the segment of a circle, but in view of the artistic development proposed it seemed advisable to give the matter a little further thought and, if possible, to select a form which would be more pleasing to the eye, while at the same time maintaining the necessary strength for railroad service.

An elliptical form seemed desirable, and upon making a comparison of designs it was found that by slightly lowering the springing line to say 7 feet above the sidewalk, and placing the additional headroom necessary in the elliptical curve rather than in the straight abutment, a more pleasing effect could be produced at practically the same cost. In fact, the only additional masonry required would be that necessary to form the curve of the ellipse, in filling the sharp abutment angle at the springing of the segmental form of arch.

The elliptical form, however, did not meet with favor from those who had constructed segmental arches, and it was only after considerable persuasion that permission to construct the ellipse was granted. After a service of nearly twenty years, however, the arch still stands, without sign of a failure or blemish, doing work double that for which it was designed. It received notice of the technical press, and was selected by Messrs. French and Ives, in their work on "Stereotomy," as a type of five-center arch, but it has never received a full description until it was given as follows to the Brooklyn Engineers' Club.

The railroad embankment, at the point where it was proposed to place this arch, was so low that a plate-girder bridge had been thought the most feasible form of construction. This, however, would have been worse, from an artistic standpoint, than the segmental arch, and, because of the limited headroom, it was found necessary to make every effort in introducing the ellipse to reduce the crown of the arch to the lowest practicable height consistent with the strength necessary and the beauty desired.

The span of the arch was 40 feet, as was customary for highway under-crossings of this kind. The height of the vertical abutment, from the sidewalk to the springing line of the arch, was placed at 7 feet, as already mentioned, and from this the ellipse arose in a graceful curve, to its crown 10 feet above, and the curve from the springing gave the extra headroom clearance desired in a much more pleasing form than would have been the abrupt angle at the springing line of a segmental curve. The length of the barrel was placed at 7 feet, so as to permit an 8-foot parapet above the arch to catch the slope of the railroad embankment. The elevation of base of rail was 5 feet above the top of parapet, making a total height of 13 feet above the crown of the arch, for placing the roadbed, the earth embankment and the masonry of the arch crown.

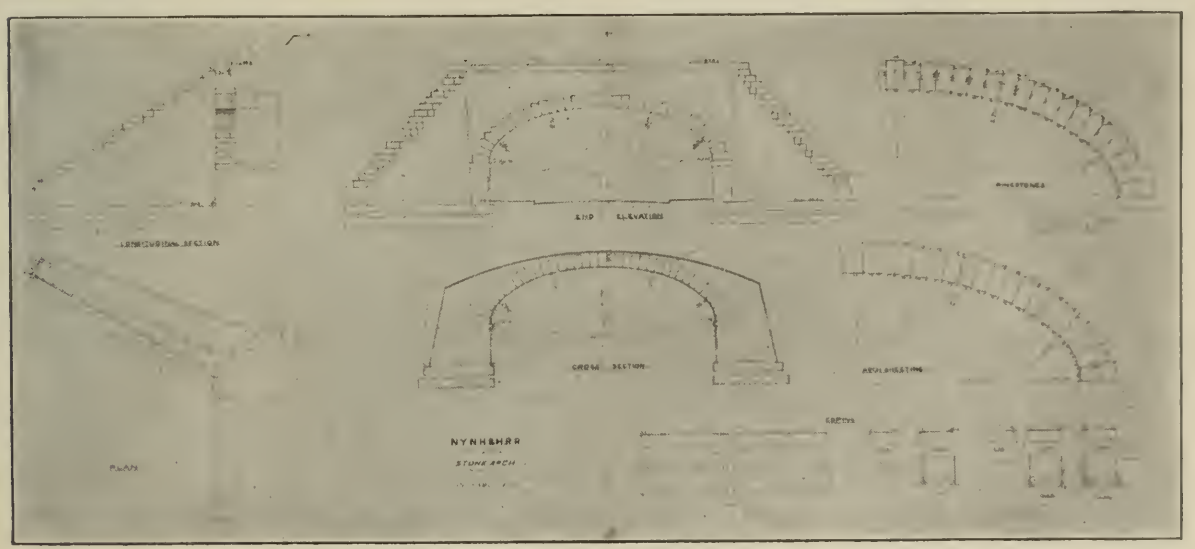
In the detailed design of the arch an ellipse was first drawn with the two axes already mentioned, and then a study was carefully made for the selection of radii of a five-center arch which would conform most closely to the lines of the ellipse. The radii of 40 feet, 20 feet, and 5 feet 7¼ inches were selected in this manner, and agree closely with the lengths which Messrs. French and Ives would select by a more exact mathematical analysis. The variation between the line of the true ellipse and that of the five-center arch drawn by these radii is only about one inch, and is not noticeable to the eye. The practical advantage of the five-center arch over that of the true ellipse is in the simplicity in laying out the curve, the facility in the stone-cutting of the arch ring and in the general practicability of the construction work.

marshy ground and necessitated excavating to a depth of 14 feet before a satisfactory bottom of compact gravel was reached.

The adoption of a five-center curve permitted of very simple stone cutting. A joint was placed at each change of curvature, this permitting joints to be radial, and each stone within the same curve was cut by the same template, requiring but three templates for the entire arch.

In the ring stones of the face the radial joints were extended to make the vertical step of the horizontal joints not less than 4 inches, and to decrease these steps in each instance from the springing to the keystone, giving an appearance pleasing to the eye and conforming to the usual rules of masonry.

The face of the arch is square to the




*Plans of Stone Arch Over Highbrook Avenue, Pelham, N. Y.*

In proportioning the arch ring a full live and dead load was used for determining the thickness at the crown, and a full dead load and a partial live load to determine the variation of the line of thrust. This line of thrust was found to lie within the inner third of the arch sneeting until the shortest radius was reached, when it passed to the outer edge of the ring stones and thence down thru the abutment, remaining within the inner third of the masonry until it passed thru the foundation. The west abutment was founded on rock, but the foundation of the east abutment was on

center line of the barrel; the wing walls were spread at an angle of 45 degrees with the face and were coped with stone steps. The face stones of the arch, the parapet and the wings were of a pinkish gneiss, quarried in the vicinity of Yonkers, N. Y., and about five miles distant. The coping was of blue-stone, quarried at Palatine Bridge, N. Y., and, when fresh, was of a dark color and made a fitting trim to the masonry; but it has grown light-colored with age and exposure to the weather. Oddly enough, the photograph taken at the time of completion showed the coping lighter colored than the face

*Forms for Elliptical Arch, Nelham, N. Y.*

owing to the actinic effect of the bluestone as compared with that of the red tinted gneiss.

The arch sheeting and ring stones were all cut accurately in the quarry and no additional cutting was found necessary at the site. The sheeting was 2 feet 6 inches deep, and the joints cut on radial lines. The first course, at the springing, was made 3 feet deep. The intrados was bush hammered, and the rock face of the wings and parapet had no projection exceeding 1½ inches. Allowance was made for ¼-inch joints.

In the construction of this arch it was first proposed to build one-half the length of the barrel at a time, and then by shifting the railroad track to the finished portion, complete the remainder. It was finally deemed advisable, however, for the safety of the traffic, to carry the track around the work on a temporary trestle. The trestle was first constructed along the side slope of the old fill, and when the excavation for the arch encroached upon the trestle, the trestle bents were then lengthened.

The wooden erection-centering was constructed of three thicknesses of 3 x 1-inch spruce lumber. The forms were spaced three feet apart and supported at the posts and at the abutments by wedges. The strips of 3 x 8-inch lagging were laid open, and spaced under the middle of each line of stones so as to leave the joints exposed to view for accurate setting, and so that the joints might be calked before grouting. The position and direction of each radial joint was marked on the centers, which fixes a point on each radius at the bottom chord and at the arch curve on the wooden center. By these lines the stones were accurately placed in their true positions, and when all were set and grouted, the wedges were slightly drawn to bring the arch ring to solid bearing throughout. The arch was finally covered with a 2-inch coat of cement mortar, and the centers were removed seven days later. The embankment was then back-filled and the railroad track finally laid in place.

For the purpose of comparing the lines of the elliptical with the segmental arch a photograph was recently taken of an example of each. These two arches are of the same span and under the same railroad, only a mile apart. The elliptical arch stands still as perfect as when built, with such leakage as may occur trailing down the steep curve of the short end radius; while in the segmental arch a roof board has been erected over each sidewalk. One springing stone of the segmental arch was cracked soon after erection, but this crack is not due to the form of the arch, but rather to the fact that the arch is askew, and on that account the cracked stone has had excessive pressure upon it. These two arches were constructed at the same time, the segmental having been commenced first, and, owing to unavoidable circumstances, finished after the completion of the elliptical arch.

The masonry was constructed under the direction of Mr. Charles Sillery, of Mt. Vernon, N. Y., and it was due to his skill as a master mason that it was completed without fault and has continued to render such excellent service since. The following items of cost were recently furnished by him, and, even allowing for the lesser wages paid at that time, these costs indicate unusual economy in management.

The stone was delivered at the site at the following prices:

| | |
|---|---|
| Sheathing and ring stones | $20.50 p. c. y. |
| Ashlar face stones | 7.50 p. c. y. |
| Coping and steps | 16.50 p. c. y. |

The cost of the wooden centers in place was $1,000, distributed as follows.

| | |
|---|---|
| Lumber for centers | $450 |
| Bolts | 100 |
| Labor, cutting and building | 90 |
| Lumber and labor for lagging | 145 |

| | |
|---|---|
| Miscellaneous labor | 65 |
| Total | $1,000 |

The cost of laying the masonry was as follows:

| | |
|---|---|
| Laying abutments | $0.75 p. c. y. |
| Laying wing walls | 0.95 p. c. y. |
| Laying sheathing and rings | 1.30 p. c. y. |
| Laying steps and coping | 1.50 p. c. y. |

Rigging and moving four derricks, $104.00.

The foundations were of concrete, costing as follows:

| | |
|---|---|
| Excavation | $0.22 p. c. y. |
| Breaking stone | 0.65 p. c. y. |
| Mixing and placing stone | 0.88 p. c. y. |

Rigging and moving two derricks, $40.00.

The plant was hauled one mile, and removed from the work at a total cost of $50.00.

*Elliptical Arch Over Highbrook Avenue, Pelham, N. Y.*

The arch was completed ready for backfill within two months after the foundations were excavated.

| | |
|---|---|
| Labor | $1.25 to $1.50 per day |
| Masons | 2.50 to 3.00 per day |

Hoister runners, $3.00.

# MUNICIPAL LIGHTING PLANT COST.

East Liverpool, Ohio, a city of 21,000, is contemplating the construction of a municipal lighting plant, and has received a report from S. B. Martin, Pittsburgh, on the cost. The following estimate is furnished from figures submitted by manufacturers and contractors:

| | |
|---|---|
| Two 625-k.v.a. steam turbines complete with 2,300 volts, 3-phase turbo alternaters, exciters, condensers and pumps | $25,000.00 |
| Two 300-h.p. water tube boilers, erected complete with stacks, stokers and brickwork | 8,500.00 |
| Four 50-light magnetite arc lamp equipments, complete with transformers, lamps and all accessories | 10,000.00 |
| Pole line complete with arc and commercial circuits | 20,000.00 |
| One 4-panel switchboard complete | 1,300.00 |
| Two boiler feed pumps | 400.00 |
| One feed water heater | 300.00 |
| Cold water supply pumps | 600.00 |
| Transformers for consumers | 4,000.00 |
| Wattmeters for consumers | 2,500.00 |
| Wiring in power house | 500.00 |
| All piping | 1,100.00 |
| Foundation for all equipment | 1,300.00 |
| Cold storage and coal handling apparatus | 2,000.00 |
| 400-lamp street tungsten equipment | 2,500.00 |
| Power house building | 8,000.00 |
| | $88,000.00 |

The arc-lighting system is contemplated to consist of 200 metallic frame, 4-amp. arc and 400 100-watt tungsten street lamps. The commercial lighting service is designed to serve 10,000 40-watt lights. The Council Committee on the municipal lighting plant is composed of James M. Gilgallon, Chris Norton and George Barlow.

# BRICK ON COUNTRY ROADS

*By Wm. C. Perkins, M. Am. Soc. C. E.,*
*Resident Engineer, Department of Highways, State of New York,*
*Niagara Falls, N. Y.*

Paper presented before Section D of the American Society
For The Advancement of Science, Cleveland, Ohio, January 3, 1913.

THE use of brick for surfacing country roads is rapidly gaining favor with highway engineers and the general public.

In 1909, the New York State Highway Commission decided to use a more permanent form of construction than macadam for the main highways leading into the larger cities, as many of these macadam roads were in bad condition, due to heavy traffic and lack of systematic repairs.

Experience has shown that a macadam roadway under heavy traffic, either wagon or automobile, is not economical, mainly on account of the high cost of maintenance.

The New York State Highway Commission, after extensive investigation, decided to use brick construction on their main highways; and, as a result, in 1910, about 20 miles of brick highways were constructed in the vicinity of the city of Buffalo. These roads proved so satisfactory to the travelling public as well as to the maintenance department (the cost of maintenance being so low), that the mileage of brick roads in the vicinity of Buffalo at the present time is about 100 miles, and this mileage will be greatly increased during the year 1913, if the present plans of the commission are carried out.

These brick highways connect the city of Buffalo and Fort Niagara (at the mouth of the Niagara River) by way of the city of Niagara Falls, and reach out, with Buffalo as a center, to all points of the compass. And I feel confident that it will not be long until every important highway leading into Buffalo will be of brick construction. This is also true of many of the larger cities of New York state, and the villages are now adopting brick construction under state aid.

The process of manufacturing brick for paving purposes has become more scientific as the demand for brick has increased and the methods of construction improved.

Streets built 20 to 25 years ago were paved with wire-cut bricks of the same size as building brick. Later, repressed brick of the small size were used. When

*Franklin Street, Buffalo, N. Y. In Front of City Hall. Photographed May 8, 1912. Nineteen Years Old. Wire-Cut Brick Without Lugs. No Separation for Admission of Grouting Material.*

the constructing engineer asked for a projection on the brick which would separate each course so as to allow the filler to enter and bind the bricks, the manufacturers placed their trade marks in the form of raised letters, on the side of the bricks. Later, more pronounced lugs were demanded; these raised letters or lugs require a reforming of the brick in stamping machines (erroneously called a repressing machine) and as a consequence the so-called repressed brick with lugs drove the old wire-cut out of the market. The size of the brick was also increased to that of the present block.

Highway engineers still demand a block with lugs, and in 1910, a wire-cut-lug block (made under the Dunn patents) was placed on the market for their consideration. During the same year, an experimental section, using these wire-cut-lug blocks, was laid on the main highway between Buffalo and Rochester, about one mile from Buffalo. This section proved so satisfactory that since that date a large percentage of the paving blocks used on the roads in western New York has been wire-cut-lug blocks.

During 1912, the records show that nearly 25,000,000 wire-cut-lug blocks were

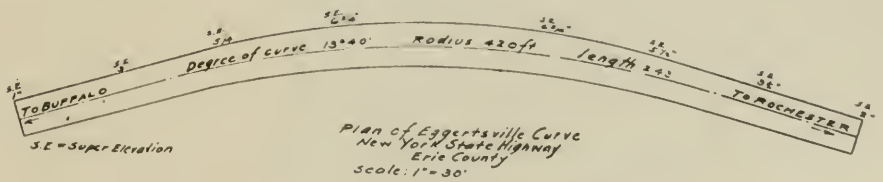
*1. Buffalo-Williamsville Road, Eggertsville Curve.*
*2. Buffalo-Williamsville Road, showing experimental section of wire-cut-lug blocks laid in June, 1910. Photographed June, 1912.*

CENSUS OF TRAFFIC
NEW YORK STATE HIGHWAY

WILLIAMSVILLE ROAD NO. 69, EGGERTSVILLE CURVE ONE MILE FROM BUFFALO CITY LINE, MAIN HIGHWAY TO ROCHESTER, PAVED 1910 WIRE CUT LUG BLOCK MANUFACTURED BY THE UNITED BRICK CO., OF CONNEAUT OHIO. BUSH & PERCIVAL CONTRACTORS, M.W. WILBUR, DIV. ENGR. WM. C. PERKINS RES. ENGR. STATE HIGHWAY DEPT.

| | 1 Horse Vehicle Light | 1 Horse Vehicle Heavy | 2 Horse Vehicle Light | 2 Horse Vehicle Heavy | Motorcycles | 2 Passenger Car | 4 Passenger Car | Freight Trucks | Total |
|---|---|---|---|---|---|---|---|---|---|
| MONDAY, JUNE 17 8AM-8PM. (WEATHER FAIR) | 61 | 25 | 12 | 42 | 68 | 101 | 278 | 17 | 599 |
| TUESDAY, JUNE 18 8AM-8PM. (WEATHER FAIR) | 144 | 33 | 11 | 38 | 44 | 77 | 345 | 20 | 712 |
| WEDNESDAY, JUNE 19 8AM-8PM. (WEATHER FAIR) | 80 | 28 | 11 | 46 | 69 | 103 | 406 | 13 | 756 |
| THURSDAY, JUNE 20 8AM-8PM. WEATHER FAIR UNTIL 6PM. RAIN FROM 6PM-8PM. | 118 | 38 | 17 | 42 | 57 | 89 | 281 | 18 | 660 |
| FRIDAY, JUNE 21 8AM-8PM. (CLOUDY & SHOWERS) | 92 | 34 | 16 | 31 | 38 | 49 | 244 | 9 | 513 |
| SATURDAY, JUNE 22 8AM-8PM. (WEATHER FAIR) | 51 | 82 | 21 | 32 | 100 | 100 | 298 | 17 | 701 |
| SUNDAY, JUNE 23 8AM-12M | 51 | 16 | 1 | 2 | 79 | 31 | 150 | 2 | 332 |
| 12M-4PM | 6 | 4 | 1 | 1 | 71 | 61 | 210 | 3 | 356 |
| 4PM-8PM. | 42 | 2 | 4 | 0 | 148 | 102 | 420 | 4 | 717 |
| TOTALS | 645 | 262 | 94 | 234 | 669 | 713 | 2627 | 102 | 5346 |

OBSERVERS, — BLAKE WELLS & MACKLEM PERKINS.




*3. Traffic Census taken at Eggertsville Curve, shown in Plate 1.*

used on the highways of western New York, altho the specifications of the State Highway Department do not specify any style of block, merely requiring them to have lugs.

### Advantages of Wire-Cut Block to Engineer

What are the advantages of a wire-cut-lug block over a repressed block to the highway engineer?

*4. Showing comparative Density of wire-cut lug block on left, repressed block on right, same manufacturer.*

*Density*: When a brick is repressed the molecular arrangement of the material is changed under pressure, and reforming may cause laminations. The fracture of a wire-cut block is smooth and even, showing great density; the fracture of a repress block shows, very often, laminations and change of form and structure.

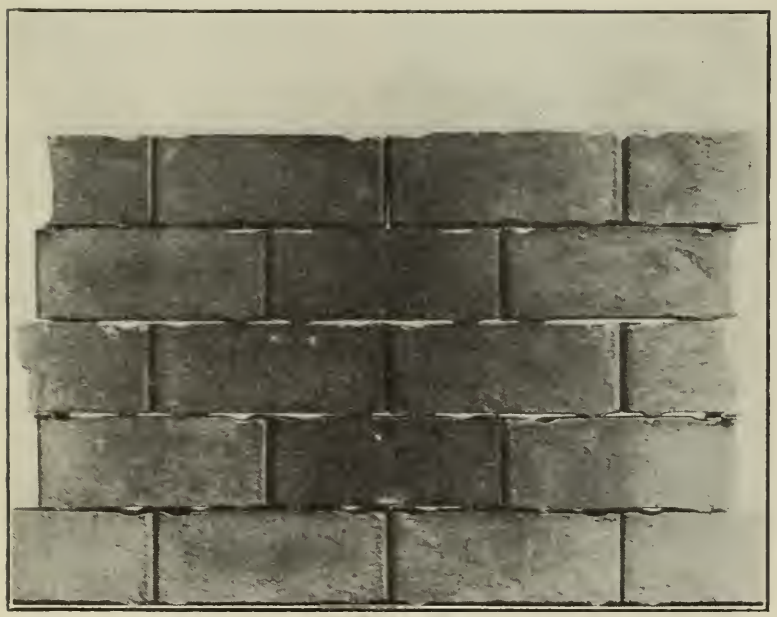
*Lugs*: The brick with its lugs being cut by a machine at one operation, consequently all lugs are of uniform size, while on a repressed block many of the lugs are malformed or a part remains in the mold.

*Bond*: The uniform lugs make a good alignment. The bricks are held an equal distance apart, allowing the free flow of filler or binding material; also, the rough, wire-cut surface, which comes in contact with the filler, gives a greater bonding strength than would the smooth surface of a repressed block.

*Surface*: The edges of the block being square and sharp, the filler can be brought flush with the surface and will not break away under traffic as it may from the rounded corners of repressed block. In Plates 7 and 8 notice the perfect condition of the wire-cut lug, while the filler is pounding out from the round-edged repress block.

The cement joint and blocks wear uniformly and the pavement is smooth to traffic. There are no depressions between the blocks to collect decaying matter, and the pavement is thoroly sanitary.

*Abrasion*: It is claimed that the rattler test shows a smaller percentage of loss from a wire-cut-lug block than from a repressed block of the same quality. If this can be proved (and I believe we can obtain authentic data from the manufacturers and testing engineers), the wire-cut-lug block must, therefore, be much stronger than its repressed brother, for the action of the rattler would be severe on the sharp corners of the wire-cut-lug block.



*5. Showing uniformity of lugs and positive separation of blocks for admission of filler.*

### Advantages to Contractor.

What are the advantages of the wire-cut-lug block to the contractor?

*Alignment*: Owing to the uniformity of the lug and the uniform size of the block, a good alignment can be obtained with very little effort and it is, therefore, possible for a

*6. Showing uniform alignment of courses in wire-cut-lug blocks.*

*1. Junction of a wire-cut-lug brick section of road and repressed brick section, on Orchard Park Road, near Buffalo. See Plate 8 in opposite direction over wire-cut-lug blocks.*

*8. Camera in same location as for Plate 7, but showing wire-cut-lug block pavement in opposite direction.*

bricklayer to lay moresquare yards of pavement in a day.

*Filler*: Flush joints are more easily obtained. Two applications of cement grout are generally sufficient, thus a saving of labor.

*Cost*: The prices of wire-cut-lug blocks have not been increased over repressed.

### Standard New York State Design

The best blocks in the world will make a bad pavement if the pavement is not properly designed and constructed. The brick highways in New York state are built according to plans and specifications of the State Highway Department, with strict inspection as to materials and workmanship.

Plate 9, Fig. 1, shows the New York state standard section for a brick country road, which calls for 16 feet of brick surfacing; 1½-inch sand bed (this will be increased to 2 inches in 1913), and a foundation of 5 inches thick of concrete, mixed 1 to 2½ to 5.

The brick surfacing is confined by a concrete edging, 6 inches wide, flush with the pavement and separated from the pavement by a well-defined expansion joint seven-eighths to 1 inch wide.

For surfacing wider than 16 feet, these longitudinal expansion joints are increased proportionally to the width of the pavement. No transverse expansion joints are used. In 1910, transverse expansion joints, placed 50 feet apart, were used with disastrous results, the blocks having become loose and crushing on each side of the joint.

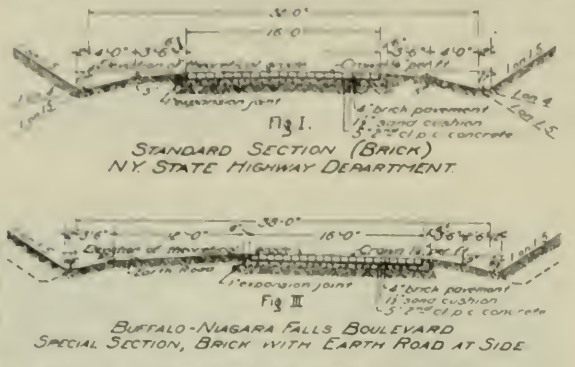
The shoulders or wings on each side of the edging are of earth, 7 feet 6 inches wide, making the width of the roadway 32 feet between ditches; normal ditches are 1 foot wide and 17 inches below the center of the road or theoretical grade; back slopes of ditches 1 on 1½; if necessary for proper drainage to deepen the ditches, or on embankment the slopes are made 1 on 4, or 1 on 1½; but if the steeper slope is used, guard rail is necessary.

The crown of the brick section is ¼ inch per foot.

Plate 9, Fig. 3, shows a special section combining a brick and earthen road used

on the highway between Niagara Falls and Buffalo.

This is very similar to the section used on the roads around Cleveland. This section has 16 feet of brick surfacing with necessary edging and wing on




9. *Fig. 1. Standard section of brick road as adopted by New York State Highway Dept.*
9. *Fig. 3. Cross-section of Buffalo-Niagara Falls Boulevard, combined brick and earthen road.*

one side of highway, and a 12 to 16-foot earthen road on the other side. This highway has just been constructed, having been opened for traffic on Christmas day, and is 17 miles in length between the city lines.

Fifteen miles of this highway is laid with wire-cut-lug blocks, the other two miles having been built in 1911 of repressed block.

The traffic, especially automobile, will be very heavy. No traffic census has been taken, but on a Sunday afternoon (two weeks before the road was opened), at a time when it was necessary to make several bad detours, 256 automobiles passed a specific point in one hour.

In the preparation of plans for a brick highway on New York state work, the designing engineer carefully examines the surveyed plan, making a new location of the center, if, in his judgment, it will improve the alignment; avoids all sharp turns, taking new right of way, if necessary. Easy grades are designed for the main highways, which often necessitates the cutting down of hills and the filling in of hollows.

The surface drainage is carefully examined, and concrete culverts used for the larger waterways and cast iron pipe for the smaller.

### Construction Details

The construction of a brick highway is in charge of a constructing engineer with a force of inspectors, and he is held responsible for the proper construction of the road and for all lines and grades. The method of construction is as follows:

The road is first rough-graded, and, when sufficient material has been excavated, the sub-grade is rolled with a self-propelled road roller until it is thoroly consolidated. Any weak spots that may develop are dug out and properly taken care of by either a sub-base course or a tile drain. In some instances a combination of the two is used. The surface is then trued up by means of picks and shovels, to conform to the cross section.

The concrete used for base is made of 1 part of Portland cement, 2½ parts of clean, approved sand, and 5 parts of crushed stone or screen-washed gravel. The mixing is done by machines of the batch type. Great care is used in having the concrete base smooth and of the same cross section as the finished template, which rests on the edging forms and is drawn along as the work progresses.

Upon this concrete foundation a bed of clean, dry sand is laid, which is 1½ inches thick when pavement is complete. This sand bed is rolled with a hand roller weighing about 200 pounds, and then brought to the exact form and crown by means of a templet of the proper shape, resting on the edgings, or on scantlings embedded in the sand. The templet is drawn forward and backward immediately in front of the brick-laying,

12. *Placing concrete base for brick pavement.*

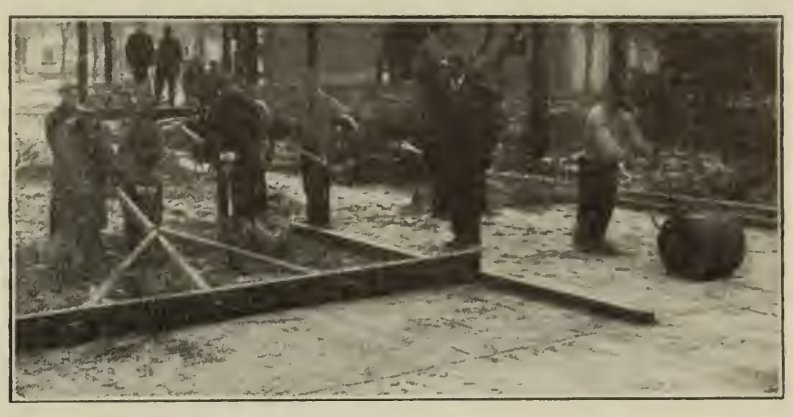
so that the sand cushion is maintained constantly at the proper cross sections.

### Laying Brick

On this sand bed the bricks are laid on edge at right angles to the edging,

except at road intersections, where they are laid at such angles as directed by the engineer. All longitudinal joints are broken by a lap of one-half the length of the brick. The bricks are laid in close contact with each other by experienced bricklayers, with the lugs in the same direction.

After a stretch of pavement is laid it is inspected and all soft, broken or misshapen bricks are removed. Any brick slightly spalled or kiln marked is turned over, and if the opposite face is acceptable, it is alowed to remain in the pavement; otherwise, it is removed. Any unevenness or irregularities of the surface, after rolling, is removed by means of ramming.



*13. Making sand bed for brick pavement on concrete base.*

### Applying Filler

The pavement is then thoroly wet by sprinkling and the filler applied. This filler and its proper application is one of the essentials of a good brick pavement. The filler used is composed of one part Portland cement and one part sharp, clean sand, mixed in small quantities and carefully applied to the brick surface by means of scoop shovels and swept at once into the joints by means of push brooms or squeegees.

*14. Laying wire-cut-lug blocks on Buffalo-Williamsville Road.*

Before the cement has attained its initial set the same portion of the work is gone over a second time, using the same mixture of grout, care being taken in each instance to thoroly fill all joints flush with the top of the brick. In order to secure flush joints, a third, four or fifth coat of grout is often necessary with blocks that have imperfect lugs.

When sufficient time for hardening has elapsed, a coating of sand is spread over the whole surface and kept moist during the heated period of the day, in order to obtain as uniform a temperature as possible while the grout is setting. The roadway is then allowed to remain absolutely free from disturbance or traffic of any kind for a period of ten days.

Some engineers advocate a weaker grout than a 1-to-1 mixture; others, a pitch filler; but my experience has been that better results can be obtained with a 1-to-1 cement filler properly mixed and properly applied.

### Expansion Joints

The object of a filler is to make the surface waterproof, prevent undue wear of the individual block, and to join all the blocks together in a monolithic structure. The joint should become part of the pavement and, as near as possible, of equal strength with the brick. All expansion and contraction to be counteracted by the use of well-constructed longitudinal expansion joints.

*15. Inspecting and rolling wire-cut-lug blocks.*

*16. First application of cement grout.*

In constructing longitudinal expansion joints, two clapboards, or wedge-shaped boards, are used in each joint while the brick surface is being rolled and the cement filler applied. After the filler has been applied, the boards are removed, the outside board being removed first in order to avoid loosening the blocks adjacent to the joint. The joint is then thoroly cleaned to the full depth of the block and the pitch or asphaltum applied.

On all sharp curves we find it an advantage to use a wider expansion joint on the outside of the curve, as the tendency of the pavement is to move in that direction and away from the inside edging.

### Tests of Brick

All bricks are subject to tests for abrasion and impact, according to the standard methods prescribed by the National Paving Brick Manufacturers' Association. In 1910 and 1911, when the old form of rattler was used, a block which lost over 19 per cent was rejected. In 1912 all tests were made on the new standard rattler and all blocks which lost over 24 per cent were rejected. Samples are taken at the roadside from every 200,000, or from any shipment which may be questionable.

### Cost of Pavements

As to the cost of brick paving on country roads, this varies according to local conditions. Highway contractors make use of various labor-saving devices to decrease the cost of construction. All unloading of stone and sand is done by machines. Many contractors are using traction engines for the hauling of material; some use small-gage tracks with locomotives and cars.

A modern concrete mixer is very necessary.

*17. Second and final application of cement grout on Buffalo-Williamsville Road.*

From data obtained from various roads, a fair estimate of cost would be as follows, based on:

| | Per Hour. |
|---|---|
| Labor | $0.17½ |
| Teams | 0.50 |
| Foreman | 0.35 |

No office or incidental charges estimated.

Labor per square yard, brick paving in place, exclusive of concrete base:

| | |
|---|---|
| Unloading and piling brick | $0.035 |
| Hauling brick 1 mile | 0.040 |
| Laying and rolling | 0.070 |
| Making sand cushion | 0.020 |
| Grouting | 0.028 |
| Expansion joints | 0.007 |
| Culling, replacing, etc. | 0.005 |
| Total labor (per sq. yd.) | $0.205 |

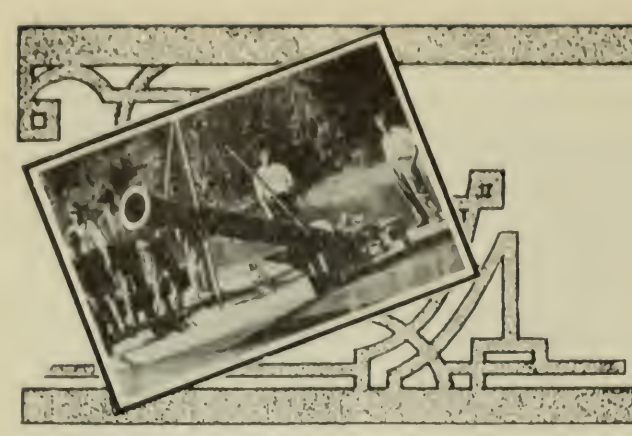
The manipulation of the concrete for the base varies from 40 cents to 60 cents per cubic yard, using batch machines and depending on gravel or stone concrete.

The average bid price for brick pavement in western New York, including concrete base 5 inches thick, but excluding excavation, is $2.05 per square yard.

The brick highways constructed by the state of New York have given general satisfaction to the traveling public. Brick is the ideal pavement for heavy traffic; is smooth to the automobilist; originates no dust; is thoroly sanitary; and, properly constructed, will be an inheritance appreciated by our children's children.

*20. Buffalo-Glenwood Road, crossing "Pipe Creek."*

*WEED CUTTER OWNED BY THE WEST CHICAGO PARK COMMISSION in operation in Garfield Park Lagoon, Chicago.*



# EDITORIAL

## GOOD BRICK PAVEMENTS

We have seen recently some brick pavements which were not good, and we have seen many miles of excellent pavements of this material, some of them well nigh perfect. We therefore welcome an article on the prevention of defects in brick pavements which states the reasons for most of the defects which have been noted and lays down the principles which will produce good results.

The work of Mr. James E. Howard in measuring the changes in brick pavements with changes in temperature has put into figures the general impressions which engineers and others have developed as the result of observation. They have unearthed little, if anything, which is new, but they have made definite some things open to differences of opinion.

As in all monolithic structures, the temperature stresses in brick pavements must be taken care of by designing and constructing the pavements under such circumstances that these stresses will not be greater than the pavements can stand, both in form and material. Brick is capable of withstanding large compressive strains. Cement joints can, also, but they will show cracks under comparatively low tensile stresses. A pavement rigidly confined, if it has a plane surface so that the temperature stresses can be transmitted in straight lines, will remain in place and will keep its original condition and even be more durable on account of a certain amount of constant compressive strain. No expansion joints are necessary.

But crowning a street introduces a weakness, for compressive stress across the street tends to force the arch up in the center and sometimes explodes the pavement. Likewise, the break in straight lines lengthwise of the pavement introduced by the crowning of the cross streets introduces a weakness in that direction. Curves in the street are equally objectionable.

Methods of construction of brick streets have been developed which make the surfaces as nearly perfect as can reasonably be expected, and careful following of the standard specifications will produce these excellent results with great uniformity. It is necessary to continue the good work by improving the designs of the pavements to equal the methods of construction. This is the problem now before engineers and contractors, and Mr. Howard's work, by making the difficulties and the reasons therefor so definite, has done a great service to the brick-paving industry and the cities using the product thereof.

## OPEN SPECIFICATIONS

The adoption of standard forms of specifications for the construction of public works by associations composed of experts is having quite an effect in opening specifications, particularly for paving materials, in many of the smaller cities.

The practice of requiring guaranties of pavements arose when paving materials other than stone and macadam were new and the promoters of one of the new materials, asphalt, were willing to back their judgment that they had a good and lasting material.

It was natural that the specifications should be more or less completely closed against competition, especially after a few years had demonstrated the claims of the first promoters, and still newer materials could not produce similar examples of success.

The fashion thus set has existed ever since, being succeeded by the open specification, first in the larger cities, whose work was heavy enough to warrant the expert supervision required to secure good materials and results, and later in smaller cities, as such experts offered themselves for service in any city desiring them.

Now come the A. S. M. I. and the S. P. S. with their standard specifications which provide for the use of all good materials of the respective classes and attempt to cut out the poorer kinds. With the aid of such gratuitious expert service in drawing up specifications and that of the professional experts in testing and inspecting materials and work, there is little need for a closed specification in any branch of public construction to insure good work.

But a peculiar condition frequently results after a change from closed to open specifications where the initiation of improvements depends, either by law or custom, upon the action of the taxpayers.

The average taxpayer, especially in the older cities and those which are less progressive or are laboring under temporary or permanent financial difficulties, is not petitioning voluntarily for improvements for which he must pay directly. It is necessary that someone should have enough interest to make the arguments and appeals required to secure the signatures to the petition. Contractors openly admit their interest and that they are responsible for most of the petitions for improvements which are presented.

But with specifications open to all materials and all contractors, the individual contractor may consider that his time and effort in securing petitions have too little chance of return in the shape of contracts. Therefore, petitions languish and improvements are not made.

Public spirit must then be invoked. Comparisons with other cities and with other sections of the same city must be made, and the pride of the taxpayers must be aroused. This is a job for the city's official family to undertake, but it must be done with intelligence and enthusiasm or public improvements will be slow and restricted to those which are so absolutely necessary that they cannot be put off, with an occasional petition from a street or district which has public spirit and desire for improved conditions enough to begin the proceedings.

# QUESTION DEPARTMENT

## Standard Specifications for Asphalt for Pavements

In connection with the letting of a contract for asphaltic concrete pavement in a neighboring city, the statement was made by parties representing the companies handling Trinidad Lake and Bermudez asphalts, that their material was far superior to that produced in this country. They succeeded in convincing, or perhaps I should say, "inducing" the council to agree with them to such a degree that their bid was accepted, although 7 cents higher than the low bid.

Will you kindly advise what is the relative values of the natural lake asphalt for this purpose as compared with the manufactured product? W., ———, Mo.

Perhaps the best reply to this question can be made by quoting the specifications for asphalt for pavements adopted by associations of experts in paving in the largest as well as in smaller cities thruout the United States.

The standard specifications of the American Society of Municipal Improvements say:

"The refined asphalts admitted under these specifications shall be prepared from a natural mineral bitumen, either solid or liquid, or from combinations thereof, by suitable and approved methods of refining."

These specifications go on to state the qualities which the refined asphalt, the fluxes, the asphaltic cement, the binder and the wearing surface shall have.

The Association for Standardizing Paving Specifications has adopted the following regarding the character of material from which the asphalts to be used in pavements shall come:

"The refined asphalt to be used for paving mixtures herein required shall be derived in the following manner:

"1. By heating, if requiring refinement, crude, natural, solid asphalt to a temperature of not over 450 degrees F. until all the water has been driven off. Crude, natural, solid asphalt shall be construed to mean any natural mineral bitumen, either pure or mixed with foreign matter, from which through natural causes in the process of time the light oils have been driven off until it has a consistency harder than 100 penetration at 77 degrees F. At least 98½ per cent of the contained bitumen in the refined asphalt, which is soluble in cold carbon disulphide, shall be soluble in cold carbon tetra chloride. In no case shall such asphalt be prepared at the refinery with any product not hereinafter provided for.

"2. By the careful distillation of asphaltic petroleum with continuous agitation until the resulting bitumen has a consistency not harder than 30 penetration at 77 degrees F.

"(a) All shipments of material shall be marked with a lot number and penetration, and ten samples taken at random from each lot shall not vary more than 15 per cent from the average penetration, providing no part of any shipment shall be below 30 penetration at 77 degrees F.

"(b) The solid bitumen so obtained shall be soluble in carbon tetra chloride to the extent of 98½ per cent.

"(c) When 20 grams of the material are heated for five hours at a temperature of 325 degrees F. in a tin box 2½ inches in diameter, after the manner officially prescribed, it shall not lose over 5 per cent by weight nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

"(d) The solid bitumen at a penetration of 50 shall have a ductility of not less than 20 centimeters nor more than 85 centimeters at 77 degrees F. If the penetration varies from 50 an increase of at least 2 centimeters will be required for each 5 points in penetration above 50, and a corresponding allowance will be made below 50 penetration. This test shall be made with a briquette of cross-section of one square centimeter, the material being elongated at the rate of 5 centimeters per minute. (Dow Moulds).

"Note: Combinations of asphaltic bitumens having the ductility and other char-

acteristics above mentioned are admitted under Section 2.

"3. Refined asphalt produced by combining crude natural asphalt with either of the following:

"(a) Residuums obtained by the distillation of petroleum oils as specified under fluxes.

"(b) Asphalts obtained by the distillation of petroleum oils as specified.

"In the use of these mixtures of refined asphalts for asphaltic cement, only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine flux without the addition of any other material, it will produce an asphaltic cement complying with the requirements set forth under that head. In such cases any of the fluxes elsewhere specified may be used.

"The preparation and refining of all asphalt admitted under these specifications shall be subject to such inspection at the paving plant and refineries as the proper city official may direct."

These specifications also go into detail as to the character and qualities of the asphaltic cements, etc. The theory upon which both organizations have proceeded is that a good asphalt pavement is the important thing, and that any asphalt which will produce first-class pavement uniformly may be used, whatever the source from which it has been derived.

## Rates for Street Lighting

Will you please inform we where I can obtain the prices paid for electric lighting in cities ranging from eight to ten thousand population. Recpectfully,

P., City Engineer, ———, O.

In MUNICIPAL ENGINEERING, vol. xlii, pp. 254 and 387, are given rates for electricity in cities of 100,000 to 200,000. In vol. xli, pp. 52 and 300 the rates for three small cities in Massachusetts and New York are given.

The rates in quite a number of electrical plants, viz., those which are electrical departments of gas works will be found in Brown's Directory of American Gas Companies ($5).

Ohio cities of 10,000 to 20,000 population pay the following rates for street lighting:

| City. | No. lamps. | Capac. | Price per yr. |
|---|---|---|---|
| Alliance | 106A | 450 w. | 65.00 |
| Bellaire | 180A | 480 w. | 70.00 |
| Bucyrus | 148A | 300 w. | 74.50 |
| Cambridge | 185A | 2000 c.p. | 65.00 |
| Chillicothe | 217A | 320 w. | 70.00 |
| | 92I | 75 w. | 24.00 |
| Defiance | 100A | 2000 c.p. | 70.00 |
| | 1001 | 16 c.p. | 8 c.kw. |
| Elyria | 257A | 300 w. | 64.00 |
| | 2501 | 55 w. | 3 c.kw. |
| Findlay | 220A | 6.6 a. | 65.00 |
| Ironton | 157A | 1200 c.p. | 60.50 |
| | 140I | 32 c.p. | 12.00 |
| Lakewood | 306A | .... | 68.34 |
| Lancaster | 910A | 485 w. | 64.80 |
| | 8I | 7.5 a. | 36.00 |
| Marietta | 218A | 2000 c.p. | 38.00 |
| Marion | 172A | 7.5 a. | 82.50 |
| Massillon | 215A | 450 w. | 69.50 |
| | 115I | 75 w. | 12.00 |
| Middletown | 173A | 7 a. | 60.00 |
| | 25I | 60 w. | 25.00 |
| Piqua | 200A | 4 a. | 70.00 |
| | 125I | 40 w. | 18.00 |
| Sandusky | 225A | 490 w. | 66.00 |
| Tiffin | 176A | 7.5 a. | 75.00 |
| | 16I | 32 c.p. | 16.00 |
| Urbana | 106A | 7.5 a. | 75.00 |
| | 8001 | 8 c.p. | 4 c.kw. |

Rates for private lights are available for a few cities:

Alliance, 12.5 to 5 cents a kilowatt hour, with 5 per cent. discount for cash, and power rates 12.5 to 2.5 cents.

Bellefontaine, 8 cents gross.

Bucyrus, 10 cents.

Defiance, 10 to 8 cents.

Urbana, 15 to 8 cents, with 10 per cent. discount.

Warren's power rates are 4 to 2.75 cents, with 10 per cent. discount in 10 days.

## Ordinances Governing Street Traffic

The city that I represent is contemplating drafting a traffic ordinance for the regulation of traffic upon its public streets. I am now gathering data for that purpose, and am inquiring for a copy of up-to-date ordinances on that subject. If you have any such ordinance in your files I should be glad for a copy thereof. J. E. C., City Attorney, ——, Cal.

Copies of ordinances governing automobiles will be found in MUNICIPAL ENGINEERING, vol. xliii, pp. 38 and 388, taken mainly from those in force in Indianapolis. Cincinnati recently adopted some additions to and changes in its vehicle ordinance which now make it one of the most complete in force. Cleveland and Atlanta also have quite comprehensive ordinances, covering the operation of all classes of vehicles, which are too long to reproduce in this department.

## Bacteria in Sewer Air

I would be much obliged for the reference necessary to look up the reports on the investigation in Gibraltar by a British engineer and that carried on in America for the Master Plumbers' Association re the question of the presence of pathogenic bacteria in sewer gases.

W. MUIR EDWARDS,
Strathcona, Can.

The investigation into the subject of bacteria in sewer air, made at Gibraltar, was made by Major W. H. Horrocks of the Royal Army Medical Corps of Great Britain, and was published in the proceedings of the Royal Society, Series B, vol. xxix, No. B 531, p. 255, in 1907.

There is a report by F. W. Andrews on the micro-organisms present in sewer air, and in the air of drains printed in supplements to the 36th and 37th annual reports of the local governing board of Great Britain containing the reports of the medical officer for 1906-7-8.

The investigation made for the Master Plumbers' Association was made by C. E. A. Winslow of the Massachusetts Institute of Technology, Boston. It appeared in a report of the sanitary committee of the association for 1907-8-9.

## Must Bids for Extras Be Advertised For?

We are now engaged in a suit with this county which involves the question as to whether or not the county commissioners had the legal right after awarding us the contract, to award us in addition to the original contract, contracts for extra work that was to be done on the building without advertising for each separate extra.

If your department is so arranged that we could obtain from you a list of referencess referring to the decisions by the different courts on this subject, we greatly desire to do so. B., ———, Fla.

If constitutional or statutory provisions prohibit changes in amount to be paid on contract such changes cannot be made. Shelby Co. v. Gibson, 18 Tex. Civ. App. 121. 44 S. W. 302; King v. Mahasla Co., 75 Iowa 329, 39 N. W. 636; Burlington etc. R. Co v. Benton Co., 56 Iowa 89, 8 N. W. 797; Reichard v. Warren Co., 31 Iowa 381; Keith v. Ozallas Power etc. Co. (Nebr. 1902), 89 N. W. 375.

But in the absence of such constitutional or statutory prohibition the county board may make the necessary changes in matters of details, and increase or decrease the price accordingly, but cannot make important general changes in the plan of the building, or insert in the formal contract, after advertisement and award, stipulations not in the specifications, advertisement, etc. Gibson Co. v. Cincinnati Steam Heating Co., 128 Ind. 240, 27 N. E. 612, 12 L. R. A. 502; Kitchel v. Union Co., 123 Ind. 540, Ex. N. E. 366; Benton Co. v. Patrick, 54 Miss., 240; Highland Co. Comrs. v. Rhoades, 26 Ohio St. 411.

Have our readers knowledge of other decisions on either side of the case?

## Consumption of Water in Cities.

What tabulated information have you which will give the approximate consumption of water per capita by the cities and towns of the United States?

B. ———, Ogden, Utah.

The volume of statistics of cities, for 1907, issued by the United States Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., gives the consumption of water in cities of over 30,000 population, and is the most recent and reliable report on this subject.

Turneaure & Russell's "Public Water Supplies" gives the consumption per capita in a number of cities.

In MUNICIPAL ENGINEERING, vol. xxx, p. 18, is a list of cities and towns of 2,000 to 5,000 population, giving the consumption of water, and in vol. xxxvii, pp. 258 and 330, are a number of brief descriptions of water works in cities of 25,000 to 30,000 population, with a statement of the consumption of water.

Reports of the American Water Works Association contain tabulations of water consumption, particularly in articles concerning metering of water systems. John M. Diven, Troy, N. Y., is secretary of the association and can supply the volumes of proceedings.

*GARFIELD PARK CONCRETE MANURE PIT AND CREMATORY of West Chicago Park Commission, Chicago.*

# Workers in the Field

## Automobile Truck for Refuse and Street Sweepings

The Editor of Municipal Engineering:

Sir—Some two years ago Commissioner Edwards took up the discussion of the motor truck with the superintendent of industries of the state prison at Sing Sing, where the carts are now being built, and found that bureau anxious to co-operate in the solution of this problem for the benefit of all the municipalities in the state with whom this industrial department is constantly doing business, and the prisoners engaged in the construction of carts and wagons under the direction of Mr. Butler, the foreman and constructor of the shop, commenced work upon a truck for this purpose. The result is that a practical machine has been built.

This auto dump cart is something unique, not alone in its construction and because of what it will do, but also on account of the conditions under which it is built. It is a remarkable fact that not one of the men who worked on the auto is a machinist. They had been bakers, bar tenders, 'longshoremen, sailors and laborers of similar capacity, and not one of the eighteen or twenty men had ever worked on an automobile or knew anything about machinery other than that they had learned in the course of their labors in prison. They were further handicapped by the fact that the cart and wagon shop is not equipped for automobile building, but had been confined solely to the construction of horse-drawn steel dump carts, such as are now used in this city by the street cleaning department and others.

The men overcame these difficulties, however, and entered into the work with interest and enthusiasm. They had books on the automobile and studied them, together with descriptive catalogues on which they spent most of their leisure hours, and they drew plans of parts and improvements, brought them to the shop, submitted them to the judgment of their co-workers and instructors, and worked in their cells during the evening hours and on Sundays trying to devise improvements or solve the difficulties met in the work. One man who became ill sent suggestions from his bed in the hospital, and when dying said that he would be satisfied if he could live to see the auto completed and ride in it once around the yard.

When in July of 1911 the prison authorities changed it was found that tho much work had been done and good results accomplished, the auto was not yet a practical machine; but the superintendent of state prisons, Col. Joseph F. Scott; the

*Old and New Methods of Carrying Away Street Sweepings and Refuse in New York City.*

warden, Mr. John S. Kennedy, and the superintendent of industries, Mr. Patrick J. Tracy, at once took up the matter of remedying the defects in the auto, and the men who were found to be most interested in their work were encouraged to

*Automobile Car for Carrying Street Sweepings and Refuse, Made in Sing Sing State Prison for New York City. Loading and unloading.*

renewed effort, and with renewed interest and enthusiasm worked, with the result that a machine was perfected and completed to the satisfaction of all concerned.

The truck is constructed of steel, has a body with a capacity of five cubic yards water measure, but when fully loaded carries eight cubic yards, and is so constructed that the top of the sides is of a reasonable height, permitting easy loading. It has a cover of a new design, which is dust proof and which will confine odors during transportation. This cover is easy to operate, is in sections having a number of doors, only one of which can be opened at one time, and which will not interefere with the loading, and are easy to operate. This cover does prevent the dust being blown about in the loading operation, which is the great nuisance attending the use of open or partly open carts. The body of the truck is dumped by a peculiar mechanism which permits it to be completely and speedily emptied, because it raises the body to a perpendicular position. This raising mechanism is composed of a worm and sector gear, here used for the first time in connection with a dump cart. This device is not only effective, but it is the safest possible, because it has a safety device which locks the body while it is being raised, so that there can be no injury by the fall of the body, and is so arranged as to stop when in exactly the right position for dumping, be held perpendicular for the dumping, and then lowered. This makes the operation of dumping completely automatic and independent of the driver, which meets the requirements usually made for such a device of its being "fool-proof." It is a stanch machine, simple in construction, and with little danger of getting out of order, even in inexpert hands. The parts can be easily and cheaply repaired.

On November 19 Commissioner Edwards visited Sing Sing Prison and witnessed the operation of this truck, and was satisfied that it thoroughly met the requirements of the department. It was given a severe test, loaded with six tons of steam ashes, and dumped as the carts are in actual work at the dumps of the department of street cleaning. The commissioner was then taken in the truck for a ride of four miles up the steep hills, which are so numerous in the vicinity of Ossining, and, though the chauffeur chose the hardest of them, the truck maintained

a uniform speed of twelve miles per hour. The commissioner was well pleased with the test, and the warden and superintendent of industries believe that they have introduced a profitable and successful industry in the prison, which, besides being profitable, is one which the men will take an interest in and in which they will gain a knowledge which will help them to become useful members of society.

DEPARTMENT OF STREET CLEANING,
City of New York.

## Cleaning of Sewers

The Editor of MUNICIPAL ENGINEERING:

Sir—Sewers should be thoroly cleaned and kept in a cleanly condition at all times.

Our first experience in sewer cleaning by means of modern machinery was a success. During our test, it is but far to state, that the work was done under conditions which should not exist owing to construction and lack of manholes. The two blocks of 24-inch sewer contained 21 inches of accumulations of sand and slag, decomposed organic and vegetable matter, and it was almost impossible to get the sewer rods thru in order to attach the front end of the turbine machine. This sewer emptied into a 36-inch sewer, which had a mile and a quarter to run to the Ohio River and was partly filled up, which you naturally would think would form an obstruction for the proper cleaning of the two blocks of 24-inch sewer. But after pulling the machine thru the two blocks, we found no perceptible difference in the 36-inch line, and the test was a success.

Clean sewers mean less gas and we all know that gas exists in sewers. Whether it be from gas mains or decomposing animal and vegetable wastes, matters not. It exists, and we know by experience that the breathing of sewer air from an open manhole or soil pipe or waste will soon cause headaches, nausea, etc.

JOHN P. PASTRE,
Sec. McKees Rocks Borough, Pa.

## How to Handle Quicksand in Sewer Trench

The Editor of MUNICIPAL ENGINEERING:

Sir—In regard to quicksand encountered in our sewer work. John Brogan, Green Bay, Wis., had a contract for $26,000 worth of sewer work, a great deal of this was thru quicksand and earth which would not stand up. The quicksand and water was usually encountered in pockets, so that it was not deemed advisable to use well points. The foreman used double sheeting and stopped running water by using sod and hay. Cinders were used as a bed to lay the pipe on, and occasionally it was necessary to have the men stand on the pipe which had already been laid in order to keep it in place. I think if well points had been used it would have been a little more economical.

M. J. DOUTHITT,
City Engineer, Waukegan, Ill.

## Fargo Declares a Municipal Dividend

The Editor of MUNICIPAL ENGINEERING:

Sir—I have your esteemed inquiry of recent date, regarding refund or dividend, payable to the taxpayers of Fargo. In explanation, I would say that when we made our annual budget for the fiscal year, on September 1st last, we found the same amounted to $146,561.00, which was to be obtained from a direct levy. This sum covered the estimated expenses for all the departments of the city for the ensuing year, and in our endeavor to reduce the amount we resorted to the following proposition:

There will be paid into the city treasury for the ensuing year, $12,000, from the following sources:

| | |
|---|---|
| Utility companies' gross earnings taxes | $6,000 |
| General license to circuses, employment agents, etc. | 3,700 |
| Dog taxes | 500 |
| Police court fines | 1,800 |

Our charter prohibits the expenditure of money unless an appropriation has first been made and the purpose of the appropriation stated; the charter also provides that no appropriation can be made except on September 1st.

Our appropriation is made on September 1st, but the taxes are paid on March 1st, six months later. We would, therefore, have normally accumulated in the treasury $6,000, from the above miscellaneous sources. But as only one-half of the annual appropriation would have been expended, we would still be a long way from the end of our annual resources and it would, therefore, be perfectly safe not only to use the $6,000 accumulated on March 1st, but also the anticipated remaining $6,000 from miscellaneous sources. We, therefore, reduced our annual tax levy $10,000 and made an appropriation of $10,000 from the above anticipated sources to the annual budget, thus making good the deficit and at the same time reducing the amount that the taxpayers would have to pay on March 1st between 6 and 7 per cent.

The purpose of this operation was to avail ourselves of the use of $10,000 for the benefit of the taxpayers which would otherwise lie idle in the city treasury at a loss of interest until September 1st

of the following year, at which time, under the old order of things, it would have gone into our contingent fund, where it would constitute a continual temptation to extravagant expenditures, as we have found in our past experiences.

The term dividend was applied because this $10,000 was the income or profits of business operations on the part of the city with private individuals and corporations, and not derived from the taxpayers, and could be deemed a dividend to be distributed among the taxpayers, or in reality, the stockholders of the corporation.

WM. D. SWEET,
Mayor, Fargo, N. D.

## Rolling Mill Cinder for Sewage Filters

The Editor of MUNICIPAL ENGINEERING:

Sir—Trouble is frequently experienced by civic engineers who endeavor to give a secondary purification to the sewage of their cities by passing it thru slag beds after it has gone thru the settling or septic tanks. For over ten years the city of Hamilton, Canada, with a population of a hundred thousand, and other adjacent cities, has had the continuous problem of securing a stone or slag, which would not only give the sewage a satisfactory secondary purifying treatment, but would not clog the filters or disintegrate. After many years of costly experimenting, during which the civic administration was harshly criticised, the engineer of that city, Andrew F. Macallum, has found a satisfactory material, which costs little more than ordinary slag or stone, and which is being investigated by engineers from various parts of the Dominion.

Experience has shown that slag with a great percentage of lime, such as that from the ordinary blast furnace or open hearth, will ultimately be affected by the sewage flowing over it, in fact, it will be seriously impaired by the constant flow of even pure water, disintegrating, reducing the open spaces between the particles of slag and, consequently clogging the filters.

The composition of the average blast-furnace slag, that used by nearly every city with filtering plants for sewage disposal, is as follows:

Silica, 34.36 per cent; alumina, 14.48 per cent; lime, 37.79 per cent; magnesia, 11.41 per cent; sulphur, 2.17 per cent; manganese, 0.34 per cent.

The open-hearth slag has even a greater percentage of lime, and hence is less desirable. Its composition is:

Ferrous oxide, 11.35 per cent; silica, 17.75 per cent; alumina, 1.72 per cent; lime, 48.90 per cent; magnesia, 5.76 per cent; sulphur, 0.311 per cent; phosphorous, 0.504 per cent; manganese, 3.45 per cent.

The new material, which Hamilton's city engineer has discovered after much investigation and experiment, is called mill cinder, is taken from a blast furnace, and is composed of the following:

Ferrous oxide, 61.92 per cent; silica, 27.92 per cent; alumina, 3.64 per cent; lime, 1.84 per cent; magnesia, 1.18 per cent; sulphur, 1.18 per cent; phosphorus, 0.066 per cent; manganese, 0.26 per cent.

This mill cinder, which has a large proportion of iron, has not so far been tried to any great extent in connection with sewage disposal plants. It is extremely valuable for that purpose, however, for the reason that it will not break down and clog the filters, and, aside from this feature, it has many good qualities. Wherever it has been tried there has been good success, and as soon as Hamilton establishes several more sewage disposal plants, two of which are at present under way, the new mill cinder will be used exclusively and given an exacting test.

The relative values at the plant of the mill cinder and the slag given in the above formulae are 80 cents for the former and 35 cents for the latter, per ton. Those who have had any great experience in sewage disposal would prefer to pay even the additional cost and secure a material that would not disintegrate and cause clogging, the bane of the existence

### Fishing in Los Angeles Parks

*The Los Angeles Park Commission provided a treat for the children last spring, when they issued an order that fishing would be allowed in the park lakes, which had become overstocked with carp. This invitation to angle was extended to children only, persons over sixteen being barred. The banks were thickly lined with small boys and girls.*

of sewage plant supervisors, which comes sooner or later where the ordinary blast-furnace slag is used.

Other materials that have been tried out in sewage disposal plants are old crockery, slate and vitrified brick. They are quite suitable, but on account of scarcity or cost it is hard to secure sufficient quantity of these for any but small plants. Coke also has been used, but it was found that it would break down shortly and cause clogging. Broken stone seems to be used in many districts, and as far as can be ascertained, it is giving satisfaction. If soft limestone is used, however, the effects are about the same as from the use of slag.

Taken all around, the experience in Hamilton so far has been that the mill cinder will fill the need of sewage disposal plants all over America.

The relative costs of the various materials placed in the filter were:

Broken stone, $1.60 per ton; slag, $1.00 per ton; mill cinder, $1.60 per ton.

HUGH L. HUMPHREY,
Hamilton, Ont.

## Regulating Standing of Vehicles on the Street

As a result of a thoro discussion of the relative rights of foot and vehicle traffic and the consequent relative widths of carriage way and sidewalks, the city of Birmingham, Ala., passed an ordinance, in December, 1912, regulating the standing of vehicles on the street, which reads as follows:

Be it ordained by the board of commissioners of the city of Birmingham, as follows:

Section 1. That it shall be unlawful to cause or permit vehicles of any kind to be placed or stationed within twenty-five (25) feet of the intersection of any two streets, or within ten (10) feet of the intersection of any alley with a street within the following described area, namely:

All that part of the city of Birmingham lying north of the center of Morris avenue, from Seventeenth street to Twenty-second street, and south of the north side of Fifth avenue, from Seventeenth street to Twenty-second street; west of the east side of Twenty-second street, from Morris avenue to Fifth avenue, and east of the west side of Seventeenth street, from Fifth avenue to Morris avenue.

Section 2. That it shall be unlawful to cause or permit vehicles of any kind, within the above described area, to be placed or stationed in that part of the street which lies opposite any main entrance or entrances of any office building, public building, hotel, theater, church or bank, and between the curb nearest the main entrance or entrances of said building or buildings and the center of the street; or to cause or permit vehicles of any kind to be placed or stationed in that part of the street lying within twenty-two and a half (22½) feet from the intersection of the curb and a line drawn perpendicularly to it from the center of any main entrance of any office building, public building, hotel, theater, church or bank; provided that nothing in this section shall be so construed as to prevent the temporary stopping necessary in getting out of or into a vehicle or in loading or unloading it.

Section 3. That any person, firm or corporation violating any provision of this ordinance shall, upon conviction, be punished as provided in Section 1,261 of the Code of Alabama.

## Commissions on Patents from an Attorney

Dear Sir—I presume that you are frequently requested by your clients to refer them to a reliable and competent patent attorney, and I am pleased to offer my services and wish to make it to your interest and advantage to refer such inquires to me, believing that an experience of more than 25 years in the conduct of mechanical, chemical and electrical cases enables me to guarantee entire satisfaction in any class of work you entrust to me.

In order that you may find it mutually satisfactory and profitable to co-operate with me, I agree to attend to all matters of a patent nature you submit to me upon a basis of an equal division of my fee, and to enable you to solicit cases, I present the following information.

The total cost of a United States patent is $70, which covers the search fee of $5, the government application fee of $15, the final government fee of $20, the cost of one sheet of official drawings of $5 and my fee of $25, of which you receive one-half or $2.50 of the search fee and one-half of my fee or $12.50, making a total of $15 as your commission on each case.

The total cost of a design patent is $40 for a three and one-half-year patent, $45 for a seven-year patent and $60 for a fourteen-year patent, the government fee being $10, $15 and $30 and your commission will be $10.

The cost of a copyright, which protects books, maps, charts, pictures and other publications or printed matter is $5, and you will receive $2 as your division of the fee on each copyright sent.

The total cost of a trade mark is $30, covering search fee of $5, cost of drawings of $5, my fee of $10 and government fee of $10, of which you receive $7.50.

I will also be willing to attend to your personal cases upon the same basis and your profession brings you in contact with the class of people who are constantly inventing and you can with perfect propriety solicit cases, and you surely will meet with success.

I am pleased to refer you to—(several names).

I hope to hear favorably and should you desire any further information, I will be glad to furnish it to you.

————, Washington, D. C.

The above letter was received by a civil engineer who transmitted it to the editorial department. It is from a patent attorney whose name is omitted because the letter is not to the editor, and because it is best not to advertise him, though his name will be given to any one who wishes to protect himself against the possibility of doing business with such a man. His offer is on a par with any other offer of commission on materials furnished or return for favors done, so far as the recipient of the offer is concerned, and is on a lower plane so far as the proposer is concerned, because he is a professional man and may be presumed to have higher ideals of professional courtesy and honor than some of those who are engaged in business without professional characteristics. If the letter contains basis for disbarment proceedings the original will be supplied if required.

## Heavy Motor Traffic on Sheridan Road, Chicago

The Editor of MUNICIPAL ENGINEERING:

Sir—We believe that the following statement of traffic record taken from 7 a. m. to 9 p. m., September 1, 1912, on the bitulithic pavement laid in the year 1905 on Sheridan Road boulevard, Chicago, from Huron street to Evanston avenue, a length of approximately 3,000 feet, will be of interest to your readers:

| Character of Vehicle. | No. of Vehicles. | Estimate of Tons. |
|---|---|---|
| Horse-drawn pleasure vehicles, estimated ½ ton each..... | 87 | 43 |
| Bicycles, estimated at 150 lbs. ..... | 187 | 14 |
| Motorcycles, estimated at 300 lbs..... | 550 | 82 |
| Automobiles, estimated at 1¾ tons.... | 6,765 | 11,838 |
| Total ..... | 7,589 | 11,977 |

Width between curbs, 40 feet.

Number of tons per foot of width, 299 tons.

The bitulithic pavement at the date of taking this traffic record had just completed its seventh year of use and had received no repairs since being laid, and has received universal commendation of taxpayers and officials.

WARREN BROTHERS COMPANY,
Boston, Mass.

## Reduction of Fire Loss in Grand Rapids

Introduction of motor apparatus is credited with being the most potent force in reducing the fire hazard in Grand Rapids. In 80 per cent of the fires in the past two years the reports show damage ranging from $5 to $200 and that the fires had but a short start when checked by the fire department.

The fire loss for 1912 was approximately $150,000, which was considerably less than in either 1910 or 1911.

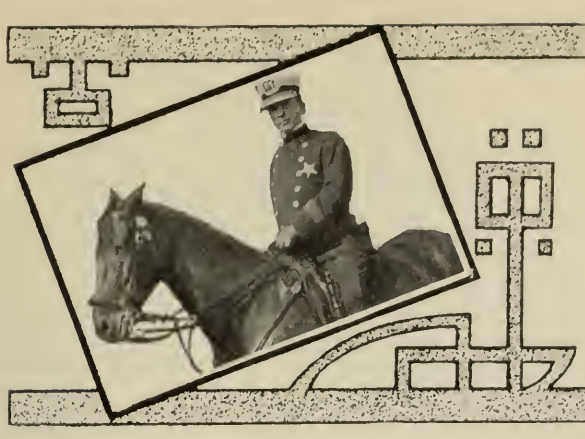
## Whistles Move Pedestrians Also

Chicago is trying the experiment of moving the crowds of pedestrians across the corners of State and Madison streets with the vehicle traffic. Heretofore the whistles, one to go north and south, and two to go east and west, have governed vehicle traffic only, and pedestrians have crossed as they pleased. The crowds have become so great and the danger of accidents to pedestrians crossing thru a stream of vehicles is so great that the council has passed an ordinance requiring foot passengers to obey the crossing whistles at the most congested crossing in the city. Pedestrians cannot pass diagonally across, but must follow the sidewalk crossings. Several policemen were necessary to keep the crowds in check on the first day of the application of the ordinance, and instruct them in the signals.

The experiment promises to be a success, and if it is the ordinance will be extended to cover all the street crossings within the loop district.

## Competition in Plans for Residence District

At its housing exhibition, which will open March 7, the City club of Chicago offers prizes for the development of 160 acres, a quarter section, as a residence district about 8 miles from the business district of the city, with the usual gridiron plats on all the surrounding quarter sections. Prizes of $300, $200 and $100 and honorable mentions are offered. Plans must be filed at the office of the City club, 315 Plymouth Court, Chicago, by March 3, and the award will be announced by March 10. Full information and specifications concerning drawings to be submitted can be obtained of George L. Hooker, civic secretary of the club.



# LEGAL DECISIONS

## Substitution of Reinforced Sewer Pipe for Reinforced Monolithic Sewer

In the case of Brobst v. the City of Reading, Pa., reported in 85 Atlantic Reports, P. 31, the contractor agreed to complete the work in "strict and exact accordance with the terms, conditions and specifications attached to it."

The specifications called for a reinforced concrete pipe, built monolithic, and the express stipulation was that, at the end of each day's work of construction, the concrete should be finished to a vertical joint, against which the next day's work should butt, the joint to be covered with a concrete ring or collar of designated width and thickness. The contractor entered into the contract with the deliberate intention of substituting a pipe known as the Leet pipe, made up of short sections manufactured outside of the trench. This pipe differed materially in the mode of reinforcement from that required by the specifications, and was two-fifths thinner. The pipe was laid by the appellant in palpable disregard of the specifications.

The pipe leaked at most of its joints, and, when he stopped the leaks by widening the trench and building concrete rings around the joints, he did only what he ought originally to have done. In no sense can this last work be regarded as extra work, for which compensation ought to be allowed; for if the appellant had laid a pipe in accordance with the specifications, and there had been leaks, he was bound, by the seventy-eighth clause of the specifications, to stop them by tearing up, if necessary, the entire pipe line and relaying it at his own expense. The answer made to this is that the city's board of public works had assented to the use of the Leet pipe. Suppose it had. Leaks in the pipe to be laid were to be stopped "at the expense of the contractor." But even if this were not so, the plea of the contractor to be paid is unavailing for another reason. His contract was with the city of Reading, and not with its engineers or board of public works. They were but its agents to act for it in the preliminaries leading up to the contract, to formulate the terms of the same and to see that they were performed; and the contractor was bound to take notice of the extent and limits of the powers of these agents. What the city engineer and the board of public works permitted the contractor to do was not the city's permission. The powers of the engineer were to interpret the contract, not to change it; and yet this is what he undertook to do. No deviations from the approved plans and specifications were to be allowed, unless by the written consent of the city engineer, approved by the board of public works. For, what was more than a mere deviation by the contractor from his contract with the city, he did not even have the written consent of the engineer.

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## Decisions of the Higher Courts of Interest to Municipalities

Extras in Sewer Contract—Relaying for Defective Alignment—Change of Grade—Where the relaying of a sewer pipe by a contractor was occasioned from its having been improperly laid out of alignment in the first instance, the city was not liable for such relaying of pipe, though it had made a slight change in the grade, which was in no wise responsible for the additional work. Where a sewer construction contract provided that claims for extras must be presented before final acceptance of the work, and no claim was presented for relaying pipe, the fact that the city allowed as an extra for the relaying of part of the pipe did not entitle the contractor to recover as an extra for the relaying of the remainder of that relaid.

City Can Pay Claims Against Contractor From Money Due Him—Under a sewer construction contract providing that the contractor should pay for all labor and assistance upon the work, and that any and all payments under the contract could be withheld until such wages or assistance were fully paid, and that 70 per cent. of the amount earned should be paid the contractor as the work progressed, and the remaining 30 per cent. be retained to secure the payment of laborers and materialmen, the city was entitled, after having exhausted the 30 per cent. in payments to lien claimants, to apply the balance on hand of the 70 per cent. to the

payment of labor and material in preference to the rights of the contractor's assignee, especially where the assignment stipulated that it was not valid as against any claim for labor and material furnished in the prosecution of the contract.—1st Natl. Bank v. Seattle (Wash.), 127 Pac. 837.

Damages for Insufficient Sewer and Inlets Thereto—Though at the time a sewer was built it was adequate to carry off accumulated water, where it was rendered insufficient by reason of a construction of a feeder sewer and of new streets and their consequent drainage into the latter sewer, a right of action accrued upon the causing of damage from the overburdened sewer, and the failure to construct sufficient catch-basins to carry off the surface water.

Water Company Not Responsible for Damage by Fire—An action *ex delicto* cannot be maintained against a water company by a taxpayer whose property has been destroyed by fire in consequence of the company's failure to comply with its contract with the municipality to furnish water for fire protection.—German Alliance Ins. Co. v. Home Water Supply Co. (Spartanburg, S. C.) 33 Sup. Ct. R. 32.

Indiana Cities Can Lease Sewer from Contractor—Acts 1907, p. 499, which provides that in case cities of a certain number of inhabitants are unable to pay for sewers constructed therein, the title shall remain in the contractor who constructs it, and that the city shall have power to grant a franchise to such contractor to operate such sewer and to lease the sewer for the drainage of the city streets, alleys, etc., is constitutional.—Jordan v. Logansport (Ind.) 99 N. E. 1061.

Engineer is Arbiter of Terms of Contract—Where the contract for a public improvement provided that an engineer should be final arbiter as to the meaning of any clauses therein, a construction by him is, in the absence of fraud or collusion, conclusive. Where the contract between a construction company and a municipality, providing that its engineer should be the final judge as to the meaning of its terms, had already been interpreted by him, a subcontractor, whose contract with the construction company incorporated the principal contract by reference, is bound by such interpretation.—Wilson & Adams Co. v. Mack Paving & Const. Co. (N. Y.) 138 N. Y. Supp. 407.

City Liable for Damage from Overflow of Sewer Negligently Constructed or Maintained—It is an actionable wrong for a municipal corporation to negligently construct or maintain a sewer, whereby surface waters are diverted, and by artificial means collected in a body and discharged upon growing crops of a private individual, to his detriment—Chickasha (Okla.) v. Looney, 128 Pac. 136.

Water Company Must Supply Water for Public Fountain—The establishment and maintenance of a fountain, at the intersection of two principal and much traveled streets, for quenching the thirst of animals using the streets, is a "city purpose," and a water company, under a contract with the city which requires it to furnish water to the extent of 12,000,000 gallons every six months free of charge for city purposes, cannot collect from said city for water supplied to such fountain.—Water Supply Co. of Albuquerque v. City of Albuquerque (N. M. 128 Pac. 77.

City Liable for Damage from Obstructed Drain and Method of Relieving Flood—Where a city grades a street across a natural water course, it, though not required to provide against unprecedented floods, must provide and maintain sufficient means for passage of the water, not only when it is at its lowest, or even at its ordinary, stage, but in time of ordinary freshets. Though a city, in grading a street across a gulch, be not required to furnish drainage for surface water, yet it, having exercised its discretionary power to do so, and constructed an adequate drain, is under a positive duty of exercising reasonable care to maintain its original efficiency, making it liable for its negligent failure in such duty. Where a city graded a street across a stream, and allowed a culvert constructed under it to get clogged, thereby causing a pond, which floated a house, and then, to drain the pond, cut the cribbing at the lower side of the fill, causing it to give way and the water to go out with a rush, wrecking the house, the city, if not liable for such wrecking as a consequence of its primary negligence in allowing the clogging, is liable if negligent in the cutting of the cribbing.—Ronkosky v. City of Tacoma (Wash.) 128 Pac. 2.

Water Company Must Repair Service Pipes in Street—In the absence of an ordinance requiring or permitting householders to repair service water pipes located in the streets, such householder has neither right nor authority, nor is it his duty, to repair the service pipe connecting his premises with the city water main, where it is located in the street, but such duty devolves on the waterworks company or the city furnishing the water.—Van Noman v. Meridian (Miss.) Water Works Co., 59 So. R. 883.

Liability for Change of Grade of Street—A city has the right to change its street grade, and to alter original plans and specifications for that purpose, and in so doing there is no negligence per se; and hence a city is not liable for interference with drainage of surface waters thereby, unless negligence in fact is shown.—Chidsey v. Pascagoula (Miss.) 59 So. R. 879.

Council Not Court Must Fix Water Rates—Hurd's Rev. St. Ill. 1909, c. 24, sec. 267f, after authorizing city councils, by ordinance, to fix maximum water rates, provides that, in case the corporate authorities fix unjust and unreasonable charges, the same may be reviewed and determined by the circuit court of the county in which the city is located. *Held,* that such section, in so far as it attempted to confer powers on the courts to review the reasonableness of rates so fixed, was in violation of Const. Ill. art. 3, relative to the distribution of powers of government, that the legislative function of ratemaking ended in the city council; and hence, alleged confiscatory rates having been adopted by a city ordinance, the water company, subject thereto, was not bound to apply to the local court for review before instituting injunction proceedings in a federal court of concurrent jurisdiction to restrain the enforcement of the ordinance, on the ground that it amounted to a taking of its property without due process of law. Where complainant water company claimed that a city ordinance fixing water rates was confiscatory, and, if enforced, would constitute a taking of complainants' property without due process of law, it was not bound to delay injunction proceedings until the ordinance had been in fact carried into effect and its confiscatory character demonstrated by actual operation, but was entitled to sue at once, assuming the burden of proving that the operation of the ordinance would necessarily be so confiscatory as to violate the federal Constitution.—Kankakee (Ill.) v. American Water Supply Co., 199 Fed. 757.

City Liable for Defect of Catch Basin Cover—Where a person passing along a public street on which there was no sidewalk was suddenly put to the necessity of stepping onto the curb by the approach of an automobile and in so doing stepped onto a catch-basin, the top of which turned and precipitated her into the basin, the city is liable for her injuries.—Colton v. Kansas City (Mo.) 145 S. W. 494.

# Roads and Pavements

## Inefficient Operation of Dayton's Asphalt Repair Plant

When the city of Dayton, in 1907, installed an asphalt repair plant of a well-known and excellent type, for the purpose of maintaining its asphalted streets, it acted wisely. But when it placed an incompetent man in charge of its operation, it acted unwisely and thereby defeated the purpose for the establishment of such a plant.

This proposition will be fully verified by the following account of its operation. The blame for the failure of the plant should not be shouldered onto the man in immediate charge, nor the superintendent of streets, nor the department of public service, nor the mayor. The entire fault does not lie at the door of any one of these four officials. The greater responsibility, however, for its failure should, in justice, rest upon the mayor and his appointee, the director of the department of public service, for both were men of larger experience than their subordinates, and should have seen to it that this new and important venture in street work had the right start. The citizens, who, by their votes, were responsible for their occupying these places of trust, had a right to expect that they would exercise good judgment in the discharge of every act in connection with the city's administration. The results show poor management, and they speak for themselves. No private business concern would have handled its affairs in such a negligent manner. So much for the blame; now for the story of the failure.

The plant was installed and equipped in the latter part of 1907, at an expense, according to the city auditor, of $13,-226.55.

The plant has been operated four years, from 1908 to 1911, inclusive. No permanent records have been kept during that period, with the exception of a loose record of materials purchased for operating the plant, and even that record does not show the source of supply, price or the total cost. The only facts and figures available for this article were found in the book referred to, the total appropriations for three of the four years in the office of the department of public service and the statement of the original cost of the plant from the city auditor. In addition, a few facts were obtained from the former superintendent of streets, included in his report for 1908, the only one made during the four years. No itemized account of the operation of the plant could be found anywhere, therefore it will be readily understood that only approximate values as to the cost of a square yard of repairs can be arrived at.

The following is a copy of the report of the superintendent of streets made to the board of public service, at its meeting, December 31, 1908:

"I herewith submit a detailed report of the municipal asphalt plant for the year 1908.

"Work on the repair of the asphalt streets was commenced about June 1. The plant was in constant operation the balance of the year, with the exception of about thirty days.

"The cost of running the plant was as follows:

| | |
|---|---|
| Labor at plant | $ 7,844.43 |
| Street labor | 10,570.04 |
| Oil | 11.60 |
| Louisville cement | 71.00 |
| Portland cement | 140.00 |
| Coal, 328,521 lbs. | 374.58 |
| Tool repairs | 84.05 |
| Repairs at plant | 355.97 |
| Chemist | 32.65 |
| Stone dust, 960,000 lbs | 2,328.00 |
| Asphalt, 949,930 lbs | 13,283.62 |
| Sand, 9,035,200 lbs | 5,239.37 |
| Flux, 71 bbls | 298.92 |
| Pitch, 88 bbls | 272.22 |
| Printing, bond and advertising | 166.75 |
| Supplies | 370.00 |
| Lumber | 242.68 |
| Telephone | 5.05 |
| Electric power | 382.76 |
| Total | $42,073.69 |
| Credit sacks returned | 701.69 |
| Net cost for the year | $41,372.00 |

"We have in the city of Dayton 446,800 square yards of asphalt pavement, or approximating 21.5 miles in linear measurement; 162,520 square yards, or 4 miles, of the above are still under the contractors' guarantee.

"All of the asphalt streets not under the contractors' guarantee were repaired and are now in first-class condition.

"During the year 46,832 square yards of asphalt repairs were laid, the maximum yardage laid in any one day of twelve hours was 465 square yards.

"At the beginning of this year the asphalt streets were in a deplorable condition, but the entire city has been covered so that today all the asphalt streets are in good condition.

"Most of the asphalt streets have been laid from twelve to fifteen years, necessitating constant repairing, and as the pavement gets older, more and more repairing is necessary. It is, therefore, evident that the annual appropriation for the street repairs should be gradually increased."

When asked how he was enabled to make out the report for 1908, the superintendent of streets said: "I had to figure it out from the accounts in the record book of materials."

"How could you tell anything about the cost of materials," he was asked, "when no record of cost was kept?"

"Oh, I had to get those figures from time slips, bills and memoranda," he replied.

"What has become of those memoranda slips?"

"They were destroyed, I suppose."

"Were you not required by the board of public service to keep a complete record of the operations of the plant, so that you could tell at all times what the repairs cost per square yard?"

"No; the board did not think it necessary. Mr. ————, the expert accountant, who was one of the three commissioners, said it wasn't necessary."

From the figures in this report and

*Municipal Asphalt Plant, Dayton, O.*

ture" kept in the material record book, the square yardage of resurfacing and the cost per square yard can be arrived at roughly. The report for 1908 gives the total number of square yards laid that year as 46,832. The net expenses for the year amounted to $41,372. By dividing the net expenditures by the number of square yards laid shows that the average cost per square yard was 88.3 cents.

The total number of pounds of mixture used in 1908 totaled 8,269,501. Dividing this number by the total number of square from the record of the amount of "mix-yards laid shows that 176.5 pounds of mixture were used to the square yard on the average. Using these averages with the record of the total amount of mixture used each year forms the basis for the following table:

| Year | Mixture pounds | Square Yards laid | Total cost year | Cost, Sq. Yd., cents |
|---|---|---|---|---|
| 1908 | 8,269,501 | 46,832.0 | $41,372 | 88.3 |
| 1909 | 5,392,225 | 30,550.8 | ..... | .... |
| 1910 | 7,198,805 | 40,786.4 | 20,000 | 49.0 |
| 1911 | 7,818,230 | 44,295.9 | 35,000 | 79.0 |

The account in the service department of the money appropriated for the plant this year was so mixed up with other street repairs that it was impossible to obtain the exact figures, so they are omitted.

If the figures given in the above table are even approximately correct, then it is evident that the plant was grossly mismanaged in 1908 and 1911, otherwise the cost per square yard would not have been 88.3 cents and 79 cents, respectively, for it is unreasonable to suppose that the cost per square yard in 1910 would have been so much lower than the other two years.

The showing is still worse when the statements of the superintendent in 1908 are compared with the facts in the table. In that report the superintendent said: "At the beginning of this year the asphalt streets were in a deplorable condition, but the entire city has been covered so that today (December 31, 1908,) all of the asphalt streets are in good condition."

Notwithstanding the deplorable condition found in 1908—presumably because they had been long neglected previously—and notwithstanding the statement of the superintendent that "all the asphalt streets had been repaired and were in first-class condition," 30,550.8 square yards were laid in 1909. And in 1910, 40,786.4 square yards were laid, only about 6,000 square yards less than were laid in 1908, when the deplorable condition prevailed.

The conditions must have grown rapidly worse, for in 1911, at an expense of $35,000, it was necessary to resurface 44,295.9 square yards—only about 4,000 square yards less than were laid in 1908.

But even with this large yardage laid in 1911, in September of that year many of the asphalt streets were full of holes, and by the 31st of December conditions were much worse. It seems strange that so many holes could be left when the repair plant worked seven months in the year, from May to November, inclusive, using 7,818,230 pounds of mixture in making the repairs.

Naturally, the holes did not grow any smaller as the weeks and months slipped by. When the new administration took charge of city affairs on January 1, the asphalt repair plant was not found in running order. The serious and prolonged illness of the new mayor, together with the necessity of breaking in a large number of newly appointed subordinates, are among the extenuating circumstances that hindered the new administration getting down to routine work. This is a fault in American city government that will be remedied some day. For the foregoing reasons and because it was claimed there were no funds to repair the asphalt plant until it was too late to do the work with the city plant, the director of public service decided to have the work done by contract.

But long before the contractor commenced work the citizens and press of the city set up a tremendous howl—and not without reason—about the frightful condition of the asphalt streets. It was freely stated on the street and in the papers that the asphalt streets had never been in such a "holy" condition, even in 1908, when the former superintendent reported them in a "deplorable condition," they were not as bad as public sentiment pronounced them last summer. So there was good reason for the people to howl.

Finally, in August, the belated work of repairing the streets was commenced. But even that did not quiet public clamor, for it was freely asserted that the contractor would run up an exorbitant bill against the city and make the work cost twice as much as it would if it were done by the asphalt repair plant. It was also asserted that the number of yards of repairs would "probably be double the amount of previous years."

Twenty-one days after the work commenced all the asphalt streets were repaired. The streets are in good condition today. The aggregate yardage was 15,526.8. By referring to the table showing the work of the asphalt repair plant for four years, it will be noted that the number of square yards laid that year amounted to more than three times as much as this year, when "everybody said that the asphalt streets had never been in such bad condition." The cost of the repairs this year amounted to $22,614.64, as compared with the cost last year, when the repair plant was used.

The average number of square yards of asphalt pavements repaired during the four years that the city plant has been used is 40,616.2, which is more than two and one-half times the repairs required this year.

The fault is not with the plant, but with the public servants who operated it. It is another case of municipal failure. But that is no reason for condemning the plant, nor jumping to the conclusion that an asphalt repair plant cannot be efficiently and economically operated by the city.

Dayton has spent its good money to install this plant, and it should demand that the present administration should use it in the future instead of employing contract labor. The present director of pub-

lic service is a man of many years' experience in the contracting field, and he now has a fine opportunity to perform a lasting service to the city by putting this plant in first-class condition and showing that a man of his experience at the head of such a department as his can perform unusual service to his city. Other cities operate similar plants at a profit to the city. What other cities have done, Dayton can do, especially thru its experienced director of public service.

[Editorial Note. There are some discrepancies in the table of cost of running the plant, which could be explained only with the fullest information, which, it is stated, is not obtainable from the records. Thus the amount of sand used and the cost of sand, asphalt, limestone dust, etc., per ton are higher than the usual figures by 15 to 60 per cent. Some of these high prices may be justified, but no information is given on which to base a justification. Likewise the method of deducing the cost of repairs each year from the more definite figures of cost given in the report for 1908 is open to criticism, as is indicated by the round numbers in the total cost per year and the great fluctation in cost per square yard.

The cost per square yard in 1908 may be compared with the cost in other cities operating municipal asphalt repair plants at about the same period taken from data published in Municipal Engineering, vols. xxxvii to xl.

Asphalt repair cost 83 cents a square yard in Indianapolis in 1909, including allowances for interest and depreciation, and 68 cents after profit on work done for asphalt contractors and others is deducted. The plant used is of the same design as that at Dayton. In 1908 the cost for street repairs was 64.2 cents a square yard. It was 52.4 cents when profits on outside work were deducted.

In Marion, Ind., in 1909 the cost, including depreciation and interest, using a small portable plant and with very few yards laid, was $1.024 per square yard, with an average depth of 2 inches.

In San Francisco in 1909 the cost of operation, apparently with no allowance for capital charges, was 95.6 cents a square yard.

In Brooklyn, N. Y., in 1909 the cost, including interest and depreciation, was 68.3 cents per cubic foot for wearing surface, or $1.024 per square yard 2 inches thick, or 76.8 cents per square yard 1½ inches thick.

In St. Joseph, Mo., in 1909 the cost was 86 cents a square yard.

In Detroit the cost in 1909 was 85 cents, a reduction from 94 cents in 1908 for resurfacing; 80 cents for repairing and 93 cents for patching. In 1910 the cost for resurfacing, including depreciation and interest, was 93.6 cents, or 92.3 cents, with credits for outside work made; 93.2 or 85 cents for repaving; and $1.031, or 93.1 cents for patching, with and without credits, respectively.

The figures of cost for 1908 for asphalt repairs in Columbus, Indianapolis, Detroit and Marion are reduced to a common basis and compared in Municipal Engineering, vol. xxxvi, p. 169, and for thickness of repair coat of 1½ inches do not differ materially from the figures given above.

It is evident, therefore, even from the meager information concerning the Dayton plant which is at hand, that its asphalt plant was not unduly expensive. An independent inspection of the plant by an expert resulted in the report that the plant is in good condition for work, requiring only such small replacements and repairs as are always needed in putting a plant in operation. The abandonment of the plant seems, therefore, to have been a mistake, which, it is believed, may be attributed to the ignorance of the new city officials regarding the matter and their neglect to secure unbiased expert advice before deciding what should be done.

Figures for 1912 for Niagara Falls may be added, being a report for the first year of operation of a small portable plant. In all 12,243.9 square yards of asphalt surface were laid, costing $12,148.05, including the plant and work done on other pavements. Deducting the cost of plant and repairs to other pavements and adding 30 per cent of cost of plant for depreciation the cost becomes $9,414.21 or 76.9 cents a square yard. Deducting the amounts paid by contractors for asphalt repairs the net cost to the city was 54.5 cents a square yard. A plant with a capacity of 500 square yards of 2-inch asphalt per 8 hours is recommended for next year, the success with the small plant has been so pronounced.

## An Expensive Indiana Road

What is conceded by road builders to be the biggest contract let in Indiana under the three-mile road law during the life of that statute was the improvement of the Walnut Tree pike, at Wabash, Ind., which serves as the southern approach to the Wabash street river bridge. The contract was awarded to Conover & Taber and over twelve months of continuous work was required to complete the task. To make a better approach to the bridge a roadway was cut thru a bluff from the top of which it is 57 feet to the roadway at the highest point. From a cut of 20 feet from curb to curb below the excavations widened to 110 feet at the top. An excellent spring was found thirty feet

below the surface of the rock and the water was piped 100 feet to a fountain. W. P. Fowler was the engineer in charge of the contract, which was awarded on a bid of $68,000.

## Road Construction in Wayne County, Michigan

The board of county road commissioners of Wayne county, Michigan, has now been at work for six years and is showing some remarkable results. One reason for this is suggested by the fact that the report for the year ending September 30, is prepared, printed and distributed before the close of the calendar year. This means close personal attention to the work by the members of the board and an efficient organization. With a varying force, sometimes as large as 1,000 men or more, organization is absolutely necessary, the work must be specialized so that each man will be put where he is most efficient and merit must be the only consideration in employing and retaining officers and men.

*An Example of Wayne County, Mich., Roads Before the Commissioners Began Their Work.*

### Concrete Roads.

Wayne county is noted for its concrete roads, some of which have now been in use for nearly four years, and their success is such that this type has been adopted as the standard for the county. Over 65 miles of concrete road have been constructed in the past four years, more than of all other materials together. Under county board supervision the mileage of roads constructed in the six years' life of the board is as follows:

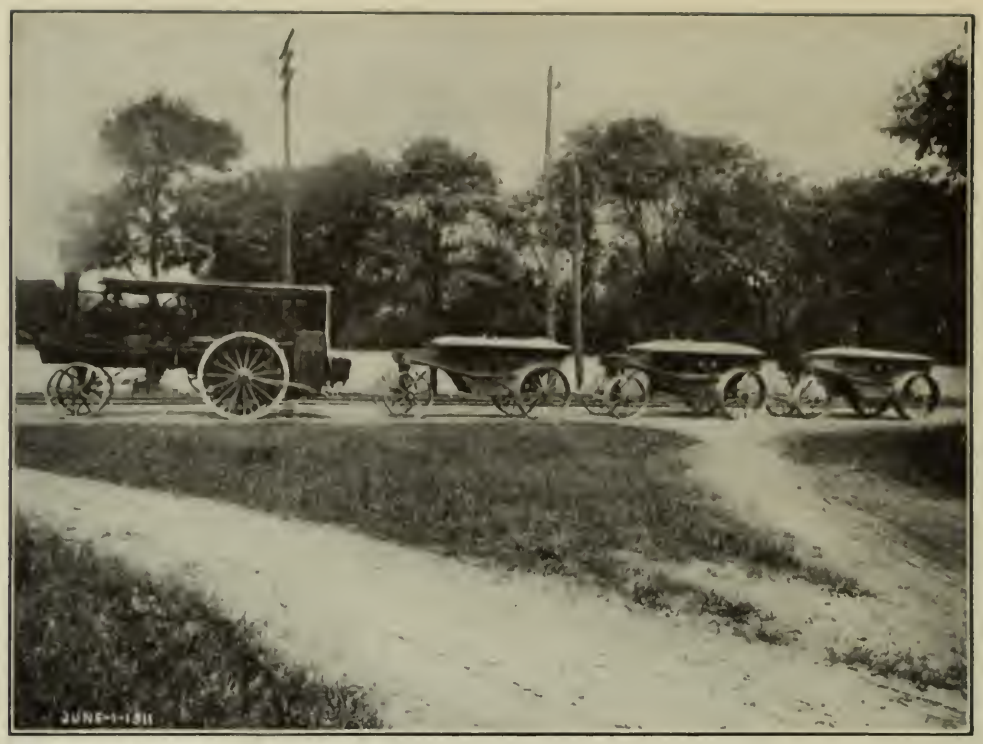
| | |
|---|---|
| Concrete | 65.745 miles |
| Gravel stone | 13.500 miles |
| Brick | 9.759 miles |
| Tar macadam | 9.348 miles |
| Water-bonded macadam | 7.500 miles |
| Gravel | 4.869 miles |
| Bitulithic | 3.000 miles |
| Creosoted block | 2.000 miles |
| Rock asphalt | 0.500 mile |
| Total | 116.221 miles |

This is less than 10 per cent of the 1,375 miles of road in the county outside of cities and villages. The township road commissioners are also active in the improvement, but more particularly in the maintenance of the roads within their townships, and under the advice and with the assistance in engineering matters of the county road commissioners they are bringing up the neighborhood roads to condition acceptable for feeders of the main roads.

### Main Roads to Be Built.

It is the intention to build ten main roads radiating from Detroit to the county line in all directions. The usual difficulty in connecting the paved city street with the paved county road, thru the less valuable property within the city limits, but on the outskirts, is experienced.

The county road law was passed orig-



*Hauling by Steam. Each Wagon Contains Seven Tons of Stone or Sand and on an Average Length Haul Will Make as Many Trips a Day as a Team if the Subgrade is Dry. The Bulk of Wayne County Road materials and supplies are hauled in this manner.*

inally in 1893, and has been used but little until the past five years or so, the adoption of the law by a county being subject to a vote on a petition of 10 per cent of the taxpayers. Under it the board of county road commissioners is established, roads are taken over as county roads, new roads are laid out, and these roads are improved. The county board of supervisors levies such taxes as it sees fit, within the limits set in the law, on due receipt of the recommendations of the road commission. The supervisors may make their appropriations as a whole or for any parts of the detailed recommendations made by the road board.

### Funds for Road Improvement.

The funds for road improvement come from three sources: (1) The county road tax, which, in Wayne county cannot exceed 50 cents per $1,000. This tax was 48 cents for 1911 and about 6 cents for 1912. No tax is recommended for 1913, the bond fund being sufficient. (2) The sale of county road bonds, authorized by general vote in 1910, $200,000 for 1911, $500,000 each for 1912, 1913 and 1914, and $300,000 in 1915, or $2,000,000 in all. The principal and interest are provided for by a small tax and the last bonds mature in 1931. (3) The state reward, which is $1,000 a mile on concrete or macadam roads, $750 a mile on gravel-stone roads and $500 a mile on gravel roads constructed under specifications approved by the state highway department.

### The Story of a County Road.

When a road is taken over as a county road, it is given a name, usually the one by which it is known to the general public. A survey, plans and profile are then made and filed with the state highway department, together with a copy of the specifications and an application for state reward, after which the subgrade is prepared and shaped, rolled hard with a 10-ton roller, and the concrete laid on the natural subsoil. Side rails of 2x7-inch lumber are used, and these are protected on top by a 2-inch angle iron. When the concrete has become sufficiently firm to permit the removal of the rail, the finishers pare off the outer edges which are formed next to the rails, to prevent a sharp, dividing line between the concrete and the gravel shoulders.

Trunk roads are built 16 feet wide, with gravel or limestone shoulders 4 feet wide on each side. The lesser traveled roads have 12 or 15 feet of concrete with a minimum width overall of 24 feet. Concrete roads 10 and 18 feet wide have also been built.

The concrete is put down wet, so that no tamping is necessary after it is placed. When this is done no workman is permitted in any way to disturb the concrete by stepping in it or throwing anything on it. The strikeoff men use a plank trimmed to the curvature of the road and iron bound on the lower edge. It rides smoothly on the iron edges of the form

boards, or rails, at the side of the concrete, and is handled with sufficient care to eliminate the necessity for any considerable floating by the followup men.

These floaters work on a bridge which rests on the form planks at the edge of the road, so there is never any contact with the concrete. This rule to keep off the concrete is rigidly enforced. Smoothing is done with simple wooden floats of home manufacture.

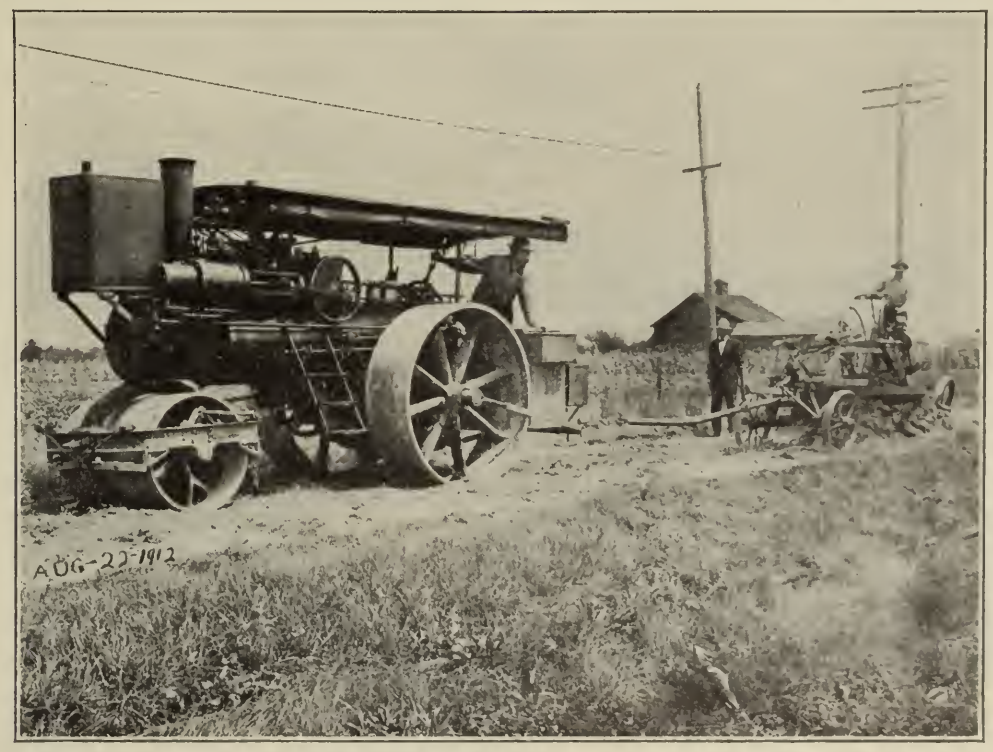
Each day's work is finished up to an expansion joint, and no more than 20 minutes is permitted to elapse between batches during the day. The work of the day is covered with canvas, and the next day the canvas is removed and the concrete covered to the depth of about two inches with any sand or loose soil that may be available to keep the concrete from drying out too rapidly. The concrete is sprinkled continuously for eight days. Roads are not opened for traffic until at least two weeks after the last concrete is put in place.

The gravel or stone shoulders are put on in layers 3 inches deep and rolled with a 10-ton roller. This work is not started until the adjacent concrete is at least three weeks old.

Machinery is used wherever the same or a better result can be secured, and it is a unique spectacle to see the large hauling engines of the commission training from two to four large wagons, each loaded with 7 tons of stone. Graders are also drawn by steam, doing the work of 6 to 8 horses, and doing it more efficiently and more rapidly. Old roads are rooted up with a scarifier or gang plow. Water is pumped for miles by gasoline engines. Stone and sand on some of the roads are unloaded with a steam grab bucket, and many smaller economical and labor-saving devices designed by the commission or its employes are in use. Cement is mixed in a mechanical batch mixer that moves under its own power, and from which a boom projects, capable of being swung in the arc of a semi-circle. The mixed material is dumped into a bucket which is run out on the boom and deposited on the road where wanted. Each batch of concrete is turned over three complete revolutions dry before water is added. A wet mix is used.

Hauling materials to the road to be used (as the mixer and gang work backwards towards the base of supplies) is done with considerable nicety, so that it is usually unnecessary to haul in extra sand or pebbles to make a properly proportioned batch.

The subgrade is thoroly wet before any concrete is placed on it in order that the water will not be absorbed from the concrete. The roads are built in 25-foot sections, with a protecting plate 3-16-inch thick and 3 inches wide at each contraction joint. These metal plates are intended to protect the edges from spalling and chipping. They are shaped to conform to the crown of the finished road, which is ¼ inch to the foot. Two thicknesses of asphalted felt (about ¼ inch) are inserted between these metal




*Grading Behind an Engine. An Economical Plan.*

plates, cutting the entire depth of the concrete. These plates are provided with shear members which tie them securely to the concrete. They also enable us to secure a more even and uniform surface to the road. The accompanying pictures will give a general idea of how the work is carried on. With the scarcity of labor willing to go into the country districts and work, results would be much less impressive and the costs a great deal higher without the various labor-saving devices used.

### Machinery Used.

In all of the work done by the board of county road commissioners the highest grade material and equipment were used thruout.

The Port Huron Engine and Thresher Company of Upton Works, Mich., supplied a large number of the heavier machines, such as traction engines, road rollers, scarifiers, dump wagons and tank wagons.

The Austin Western Company, limited, of Chicago, furnished road graders and scarifiers.

Pumps and pumping engines were furnished by Fairbanks, Morse & Company of Chicago.

The Western Wheeled Scraper Company of Aurora, Ill., manufactured some of the graders used and a considerable number of smaller machines and equipment, such as scrapers, road drags, tool wagons, etc.

Universal Portland cement was used thruout and practically all of the roads were reinforced with the special reinforcement of the Thomas Reinforcement Company of Detroit, Mich.

Baker joints and contraction plates were used for insuring even joints.

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## Road Construction in Rush County, Indiana

During 1912 Rush county, Indiana, constructed 200,730 feet of gravel and macadam roads at a cost of $190,191.50. This is practically 38 miles of road at $5,000 a mile, almost exactly. Gravel roads cost $3,510 per mile; macadam cost $5,947; macadam with gravel top cost $5,436, and water-bound macadam cost $5,380. Contracts were let for nearly 28 miles more of road, which will be constructed next season. About 40 miles more of roads have been petitioned for, but have not yet been let. Most of the petitions are for macadam or gravel, but one is for macadam and brick; three are for bituminous macadam, and one may be built of concrete. Adolphus Cameron is the county surveyor and William Dill is the deputy, who devotes himself to the roads.

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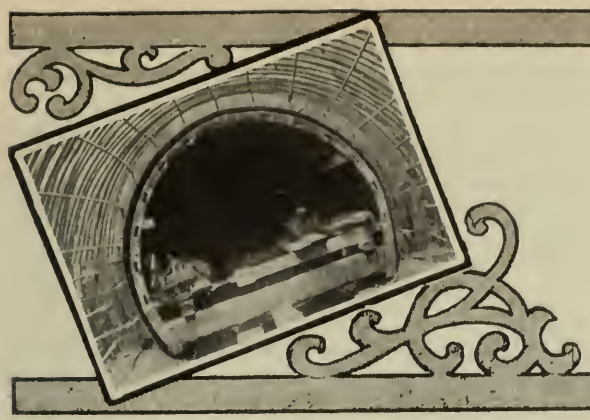
*IRRIGATED TREES on Jackson Boulevard, near downtown district, Chicago, and cared for by the West Chicago Park Commission.*



# SANITATION

## Municipal Plants for Electrolytic Sewage Purification

*By C. L. Edholm, Los Angeles, Cal.*

TWO enterprising Western municipalities have adopted a modern system for purifying sewage by electricity and are thoroughly satisfied with the modern method of eliminating the odor and destroying the disease germs therein. One of the plants is at Santa Monica, Cal., and it has been in operation since 1908 with complete success. The other is at Oklahoma City, Okla., where a plant was installed to take care of 750,000 gallons of sewage in 24 hours. This was found so efficient that a second plant has been ordered and is now under construction for use in the "packing-house district," where three times the amount of sewage and slaughter-house refuse will be electrolytically treated. The present outlet is into the river below the city and constitutes a serious nuisance, which will be abated by the new system.

The value of the electrolytic process has been demonstrated at Santa Monica. The city's sewage is discharged into the sea from the end of the municipal pier, a pleasure resort in the best part of the city. Raw sewage thus disposed of would be offensive to all visitors to the pier and would depreciate values for adjacent beach lots. With the deodorising process in use, however, the average frequenter of the pier is unaware that there is a sewer in the neighborhood, and the nearby property is a most attractive residence and apartment house section. For a few days, the plant was shut down and the difference became extremely noticeable; complaints followed thick and fast from residents and visitors, and did not cease until the operations were resumed.

Although its presence is not advertised, visitors are welcome to inspect the Santa Monica plant, and even a casual inspection is of interest. The sewage is treated in an underground chamber, built at the end of Colorado avenue where it enters the municipal pier. Only a flight of concrete stairs, leading from the sidewalk to the room under the street indicates that there is anything of the sort below the street level. The stairs lead to a concrete chamber about fifty feet long, divided by a wooden partition into two rooms, the first containing the electrical apparatus, motor, switchboard, etc., while the second contains three open troughs thru which the sewage of the city is flowing. Yet the air in that unventilated chamber is as clean as the atmosphere above ground. The secret of this is the series of electrodes, ten in each flume, around which the sewage flows. They are composed of metal plates, 9x24 inches and 3-16 of an inch thick, set upright and half an inch apart. There are 29 such plates to each electrode. The flumes are 30 feet long, 22 inches wide and 18 inches deep, and the sewage is admitted to them by gates at the upper end and flows slowly to the outlet at the lower end, whence it enters the discharge pipe that conveys it to the sea. In flowing between the plates of the electrodes, this liquid is subjected to the influence of an electric current of about 2 volts and 800 amperes, and to the chemical action caused by the decomposition of the plates of the electrodes.

*Raw sewage flowing through these troughs is treated with electricity deodorized and rendered innocuous.*

The chemical action is stated concisely by Howard V. Hinkley, consulting and supervising engineer, Oklahoma City, in a recent report:

"The process is electro-chemical. Oxygen, hydrogen and chlorine are liberated in the nascent state; are powerful reagents and render the effluent neutral —a result not obtained by either chemical or biological treatment. Owing to the oxidization no traces are left of albuminous or nitrogenous bodies, which give so much trouble in the way of secondary putrefaction in the septic treatment. Nitrites are changed to nitrates and the iron and copper compounds coagulate and clear the effluent. The oxy-chloride of lime and magnesia destroys dangerous (including typhoid) bacteria, while the free sulphuric acid generated in the process kills cholera germs, if present."

The valuable fertilizing properties of sewage are not lessened, but rather increased by these changes, and while the plants now in use allow the treated liquid to run to waste, there is no doubt that use will be made of this water for irrigation and fertilization in other cities where conditions are favorable. This would be of special value in semi-arid sections where water is at a premium, and where the science of irrigation is well understood. In this way, the cost of operating such a plant may be repaid by the sale of the treated sewage.

The cost of installing the Santa Monica plant was $10,000, while the one at Oklahoma City was built for $12,000. The one under way in the latter city will cost $45,000.

The cost of operation will vary in different cities, according to cost of current, wages of attendants and topography of the city. For instance, a pumping plant must be maintained at Santa Monica to raise the sewage from a reservoir to the forebay which discharges into the flumes, but in other places this might be avoided by constructing the flumes on a lower level than the reservoir. The table which follows is from the Oklahoma City report, above referred to:

*The large building is the electric power plant of Santa Monica, Cal. The smaller building on the left with the numerous open windows contains the apparatus for electric treatment of sewage.*

| | Per Annum | Per Million Gallons |
|---|---|---|
| Electrical current | $709.50 | $2.59 |
| Attendant | 660.00 | 2.41 |
| Lights | 40.00 | 0.15 |
| Total operating | $1,409.50 | $5.15 |
| Renewal of plate | 200.00 | 0.73 |
| Depreciation of electric machinery | 100.00 | 0.37 |
| 5 per cent. on investment | 800.00 | 2.92 |
| Total operating and fixed charges | $2,509.50 | $9.17 |

The interest was computed upon the sum of $16,000, of which $1,000 is for attendant's house and $15,000 for the cost of the plant. The actual cost of the plant was only $12,000, but this was built at a low price in order to demonstrate what it could do. Such a plant would cost $15,000 at the regular price.

It will be noted that only one attendant is required, who receives $660 per

*Looking down on electro sanitation equipment. View from opposite end of building as shown in preceding photograph.*

annum and use of house. This indicates that very little labor is required, and it may be added that one man could attend to several similar plants, if conveniently located, as they require only a few minutes work each day. The cleaning is accomplished by means of a double-throw switch, which enables the operator to reverse the current. An occasional washing of the flumes and plates with a garden hose completes the cleansing process.

In referring to the low cost of installation and upkeep, it may be stated that considerable reduction of expense per million gallons would be possible in the operation of large plants, such as would handle the sewage of a great city. The inventor claims that no less than 50 per cent reduction could be made. Compensation for the initial outlay would result from the fact that lands now made almost worthless by the proximity of sewer outlets, would no longer be undesirable, and would increase in value. Of course, the benefits to the community from a sanitary standpoint by a purification of the sewage that removes the germs and odor, are too obvious to require comment.

The power plant and grounds give evidence of care in designing with reference to appearance, and the sewage disposal plant itself is not objectionable, tho a little more attention to conformity of its design with that of the adjoining building would have produced a better appearance.

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## Commission Form Barely Wins

The city of Ottumwa, Ia., has adopted the commission form of government by a vote of 1,351 to 1,275.

## Garbage Reduction in Chicago

Until six years ago, Chicago followed the primitive and unsanitary custom of dumping all its garbage in clay holes within the city limits. This practice created such an unbearable nuisance in the localities adjacent to these city garbage dumps that in 1905, Joseph Medill Patterson, then commissioner of public works, vigorously called the matter to the attention of the city council by a report which recommended that the city's garbage be disposed of by the reduction process.

On May 14, 1906, the city council ordered the commissioner of public works to advertise for proposals for the final disposition of garbage. In response to advertisements five bids were received. One of these was submitted by O. M. Bake, Walker P. Hall and J. P. Christian, who offered to dispose of the city's garbage in accordance with the specifications for the sum of $47,500 per year. Two months later the city directed the commissioner of public works to accept this bid. On August 30, 1906, the commissioner of public works executed a five-year contract with the Chicago Reduction Company, a corporation formed by the successful bidders and other persons. Before the contract was executed it was assigned by Bake, Hall and Christian to the Chicago Reduction Company.

The city council on June 29, 1908, passed an ordinance directing the commissioner of public works to enter into a new contract with the Chicago Reduction Company for a period of five years, ending September 1, 1913, upon practically the same terms.

The city of Chicago collects its own garbage, hiring teams by the day to haul its garbage wagons. The garbage of the west and north sides is hauled to the loading stations at Oakley avenue and at Chicago avenue, whence it is conveyed by boat at the city's expense to the plant of the Chicago Reduction Company at Thirty-ninth and Iron streets. Most of the south side garbage is hauled in wagons directly to the plant. On account of the distance, the garbage of the eighth and ninth (old thirty-third) wards is not conveyed to the Chicago Reduction Company's plant, but is deposited along with ashes and rubbish on a city dump near Fifty-ninth and Yates avenue. It it admitted that garbage from the thirty-fifth ward is dumped near Riverview park, and that vegetable refuse from South Water street is dumped at Forty-seventh and Robey streets and elsewhere.

The plant of the Chicago Reduction Company is located at Thirty-ninth and Iron streets, a distance of 4¾ miles to the southwest of the center of the city.

*Top of refuse destructor showing frames over openings to cells, the cell covers closed and at the left of the box full of refuse lowering into position to dump with the cell.*

Steam roads reach the plant of the Chicago Reduction Company thru the Belt line.

The Chicago Reduction Company has a frontage of 380 feet on the Chicago River, and by laying a short distance of track will be accessible also by street car lines to the city. This furnishes transportation facilities by water, steam railway, electric car or vehicle.

The principal buildings are of a modern and permanent construction, being built of brick and reinforced thruout, well lighted and ventilated, making them fireproof and sanitary, and representing an outlay of a vast sum of money. These buildings are equipped with patented and modern machinery, especially designed to handle the inconsistent mass of pure garbage, completing the process of sterilization, reduction and disposal from start to finish within a few hours from its delivery. They are shown in the accompanying birdseye view, which shows the plant from the land side, where wagons drive up, are weighed and driven to the left for unloading in the building at the left back corner, not shown in the birdseye view, but seen in the photograph showing the handling of the garbage as it arrives.

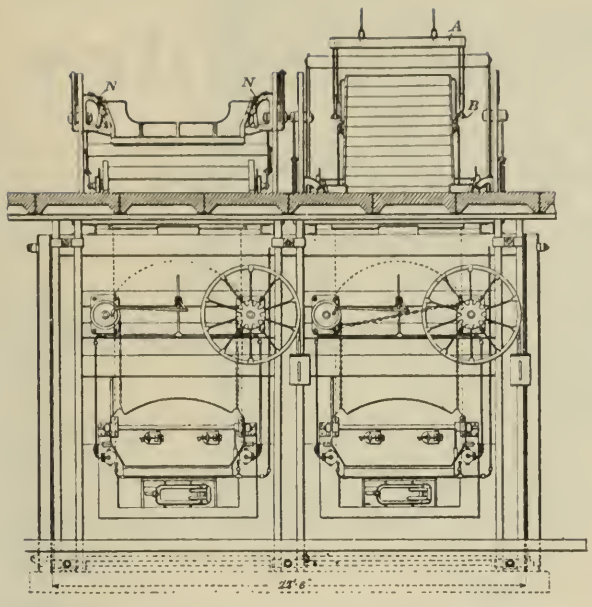
The large building on the right is the extraction plant. The mill building, the grease tanks and scale house, condenser house, naphtha plant, power house, office, etc., follow in about the order named, toward the left. The receiving, sorting, pulverizing and drying buildings are at the extreme left.

The present capacity provides for 700 tons of garbage daily, but the present city deliveries are only averaging about 350 tons per day, and about 200 tons of pure garbage are still being daily scattered in open dumps.

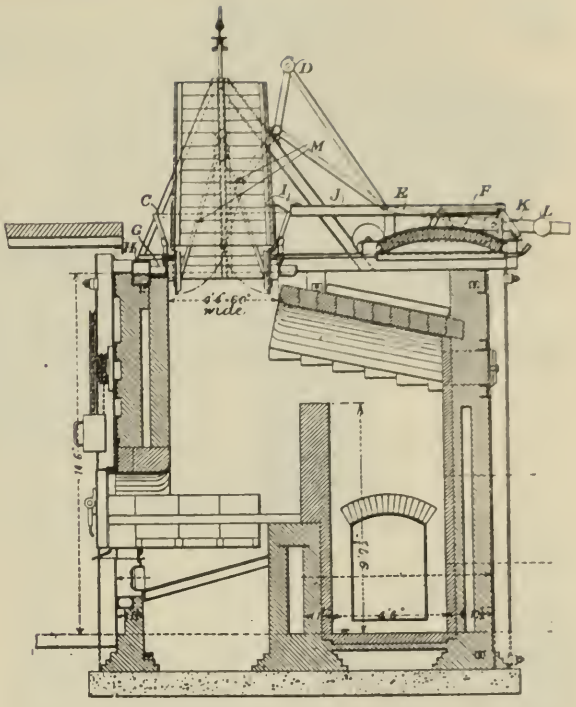
The sanitary district of Chicago furnishes motive power for all machinery.

The garbage is delivered to the plant in sanitary, closed steel boxes and wagon beds on the road, and scows on the river. In the future the boxes may be conveyed by steam railway or by electric street cars from the outlying territory at a very nominal cost to the city. The boxes are hoisted from the scows or wagon boxes by derrick, and their contents are then dumped to moving platforms, which convey them into the receiving buildings, where all foreign matter such as metal, cans, wood, paper, etc., is eliminated by hand picking. After the boxes are dumped they are swung back, cleansed and sterilized in a large deep steel vat.

The garbage leaves the receiving building after being thoroly crushed in pulverizing machines, and a series of conveyors delivers this crushed garbage automatically into the hot-air dryers. In all there




*Front of furnace showing feeding box above, and frame of cell cover. Below are stoking doors and clinker doors beneath them.*




*Section thru destructor cell showing box above with gates open to dump, mechanism for opening and closing cell cover, section of grate and combination chamber.*

are ten dryers, eight of which are six feet in diameter and forty feet long, and two are eight feet in diameter and seventy-five feet long. Crude oil has been adopted for generating the heat necessary for drying, thus eliminating all obnoxious coal, smoke, ashes, etc. The daily consumption of oil is about 14,000 gallons. This process of drying eliminates about 75 per cent of the moisture carried by the garbage.

The modern condenser house, thirty feet wide, forty feet long and sixty feet high, together with three concrete stacks six feet in diameter and 200 feet high, completely absorbs all gases and vapors of the steam coming from these dryers.

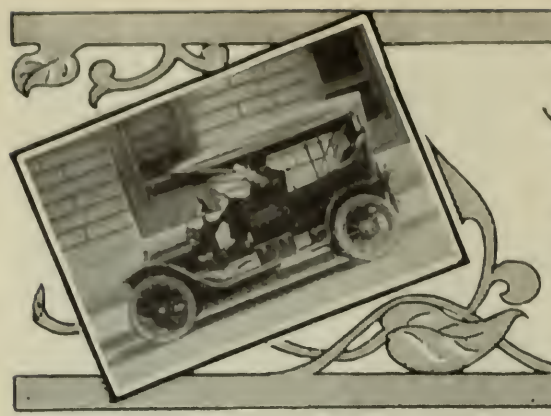
After the garbage has been pulverized and dried, it is then delivered to the naphtha plant, where same is treated with gasoline in order to separate and recover the grease contained in said garbage. The process of recovering this grease is expensive and requires skillful help. After the grease has been extracted from the tankage, it is re-dried in another set of dryers, using crude oil as fuel, and is then ground in the mill, and from these shipped to the fertilizer trade, where garbage tankage has found a market as a filler for fertilizer.

A set of boilers installed in the power house furnish steam used in connection with the naphtha extraction process and the driving of hoisting engines.

The Chicago Reduction Company, whose present contract with the city of Chicago expires in September, 1913, has, thru its president, W. A. Julian, recently made and advertised a garbage offer, which, in part, reads as follows:

We will execute a contract with the city, giving suitable bond, to handle the garbage of the city for a period of five years similar in terms and conditions to our present contract, except with a reduction in the bonus to be paid us of $17,500 a year, making the amount to be paid us by the city $30,000 per year, or $150,000 for the full period of five years, instead of $237,000, making a saving to the city for that period of time of $87,500.

Or, we will make a contract with the city to continue to handle its garbage at our present site for a term of five years, by the terms of which the city will pay us $90,000 per year for that period of time, and at the end of the contract we will turn over to the city our plant, with such enlargements and improvements as shall be made, so that the city will then own this plant with a fee simple title to the land (3½ acres) and its improvements clear of all encumbrances.



# Automobiles in Municipal Service

## Automobile Pay Car for Detroit City Employes

The idea for an automobile pay car suggested itself to the Cartercar Company as a result of the waylaying of an elderly officer of the Detroit police force, who was knocked down and robbed of several thousands of dollars in broad daylight a few months ago. This money was for the pay of the city employes. The car shown in the photograph is kept at the Cartercar garage and is driven to the city hall at 8 o'clock every Wednesday morning. When the paymaster is ready to make his rounds, he and the police officers ride off in the car and when thru, leave it in front of the city hall to be called for at night by a driver from the garage. This makes it cost the city a small sum for upkeep expense.

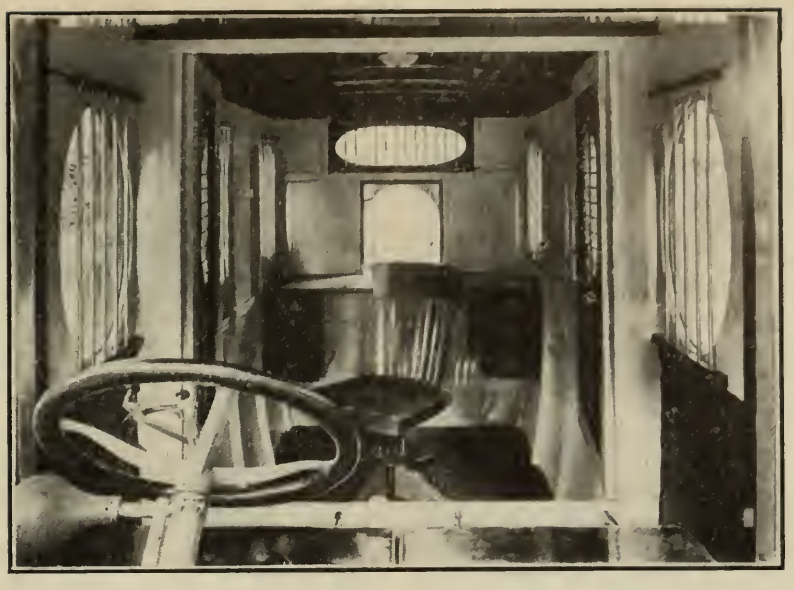
The entire car is built on the regular Cartercar chassis. It has a friction transmission, which enables it to be handled very easily and quickly. There is an unlimited number of speeds which makes it very desirable in travelling in out-of-the-way parts of the city. The entire car presents a very handsome appearance and is such that it is a credit to the city.

Two police officers are detailed to go with the paymaster each Wednesday. One of these officers drives the car and the other rides beside him at the left. The front is the only possible access to the funds and with the two bluecoats riding there, there is very little danger of a holdup.

The second photograph shows the office arrangement of the interior. The latticed doors at the front of the car have been swung back and the back of the front seats turned down so that a good view of the interior of the car can be taken. The revolving office chair and desk are clearly shown. The desk is arranged on a level with the pay window at the back of the machine. At each side are three drawers, arranged in sections so that the pay envelopes can be placed in them numerically. The window from the outside comes so it is about even with a man's head, making it impossible for him to see into the drawers where the pay envelopes are kept. A large number of envelopes can be arranged in these drawers and found very quickly, making it possible to pay a long line of men with little difficulty.

The three windows at each side of the car are covered with bevel plate glass and brass bars on the inside insure further security.

*City of Detroit Pay Car Showing Method of Paying City Employes.*



*Interior View of City of Detroit Pay Car.*

## Economy of Motor Fire Apparatus in Springfield, Mass.

No more convincing proof of the great superiority of motor-driven fire apparatus over horse-drawn types can be cited, both with respect to efficiency in preventing fire losses as well as in the actual saving of departmental expense, than the recent report submitted by the chief and fire commissioners of Springfield, Mass.

There are now 22 pieces of motor-driven fire apparatus in the service of the department and a very interesting comparison is shown by reference to the report of 5 years previous when the city had only three motor-driven machines, consisting of a combination hose and chemical and two chief's cars.

The number of alarms answered by the department in 1907 was 498 with a property loss of over $535,000, while in 1912 829 alarms were responded to with a total loss of only $166,000.

Although one bad fire was responsible for a large part of the loss in 1907, it is nevertheless plainly evident that the increase of motor-driven apparatus in recent years has enabled the department to take care of a much greater number of fires, with far less property loss than would have been possible with the old horse-drawn equipment.

Further important facts are revealed as regards the saving in upkeep cost by comparing the reports of 1911 and 1912. The total expenditure for the latter year amounted to a little over $239,000, and included, in addition to current expenses, four large pieces of motor-driven apparatus, a new up-to-date fire house and an increase of 32 new men to the pay roll. In spite of unusual expenses and the added fact that 100 more alarms were responded to during this year than in 1911, a saving of nearly $8,200 was made the previous year's budget; surely a very strong argument in favor of motor-driven apparatus from the standpoint of upkeep cost alone.

Chief Daggett sums it all up in a terse phrase when he says "Motor-driven fire apparatus is without question one of the best investments any city can make and will pay handsome dividends in the saving of property, as well as in economy of departmental expenditures."

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## The Half-Ton Truck

The Mercury truck, manufactured by the Mercury Manufacturing Company, Chicago, meets the requirements of many municipal departments having use for a motor-driven truck of 1,000 pounds capacity. City engineers, department commissioners and park superintendents constantly find it necessary to transport tools and supplies from one section of the city to another. Such work must be done in speedy fashion, and for such purposes horses are too slow and trucks best suited for heavy hauling are too expensive.

Health, meter, lighting and water departments have many uses for the light truck, also engineering departments, bridge building, paving and sewer inspectors and municipal contractors.

The labor of horses has long been one of the expensive items of municipal department maintenance. In order to have motive power available during the busiest seasons of the year the municipality has been compelled to feed and house horses thru several months of practical idleness. Taking eight hours as an average day and three hundred working days, figures show that the average municipal horse works only one-third of the work-

ing time and is idle two-thirds. Municipal officials are learning what it costs to do their light hauling with horses, and trucks of light capacity are being rapidly installed thruout this country and Europe. Many of those officials who have kept records between the cost of operating half-ton trucks and the number of teams necessary to do the same amount of work assert that the entire investment on the machine can be written off the books within 1½ to 2 years, and these conclusions have been reached without figuring the saving on account of a greatly reduced operating and storage expense. This saving is due to the fact that the muncipality is paying for what it really gets and really makes use of in the motor truck.

The cost of fuel to operate a light truck when running is less than the cost of horse feed for horses to do the same work and then this truck requires no fuel on Saturday afternoons, Sundays and holidays when it is not running. Horses eat on Sundays as well as on any other day. There is also a saving in men.

## A Well Drilling Tractor

The Armstrong gasoline tractor driller, made by the Armstrong Manufacturing Company, Waterloo, Iowa, contains a number of features which are appreciated by contractors and engineers.

The two speeds ahead and two reverse are obtained without the use of the usual train of gearing. The simplicity of the transmission gives the highest possible efficiency while running on either high or low gear.

As a rule, it is a matter of too much power for operating the drill in actual drilling work, or not enough power to pull thru heavy roads, up a steep hill or out of a bad hole. If you have too much power for drilling it means that you are using more fuel than necessary all of the time you are drilling, in other words, a part of your profits are being constantly and needlessly wasted in fuel in order that you will have power enough to move your machine; and remember that from 95 to 98 per cent of the time you are drilling that is where you get your profits and profits increase as cost of operation decreases.

You buy a tractor, to be independent of horses for moving, to cut out the expense of feeding horses that are used only occasionally, to decrease your moving expense, to save time; in other words, to increase profits.

If you do not have sufficient power for moving (and that means on good or bad roads—roads that would be passable for horses) you are only increasing your investment, your cost of operating, your necessary delays, and in place of increasing profits, you are decreasing them.

A man operating a traction machine does not want to find it necessary to call on his neighbor to pull him out with a team or several teams of horses. This expense and delay is unnecessary if the proper equipment is purchased.

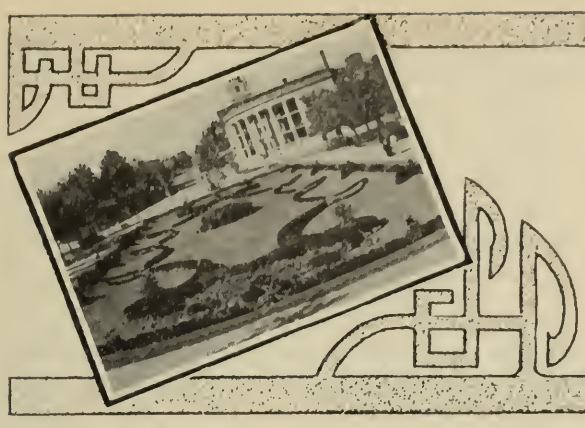
The power of the engine is transmitted to the clutch and from the clutch thru two short drive chains to the counter or drive shaft in the transmission frame (the two chains being provided with the different size sprockets to obtain the required two speeds).

This gives an efficient, flexible and noiseless transmission without the use of the usual number of gears. The chains are of brushed steel roller type. The links are of steel with case-hardened bushings and pins and having rollers of a special malleable iron to withstand wear and heavy shocks.

One lever controls the operation of the friction clutch and the friction brake. This lever engages the friction clutch when thrown forward and operates the friction brake when thrown backward. With this arrangement it is impossible to throw the clutch in while the brake is on and also allows the operator to apply the brake instantly when the clutch is released. This eliminates the danger of breakage and all unnecessary wear and tear on the machine.

## Convicts as Road Buliders

The highway improvement convention, held at Springfield, Ill., January 31, under the direction of the Illinois Manufacturers' Association, discussed the question of the employment of convicts on roads. They have been employed in that state in preparing materials for making roads, and men prominent in Illinois labor circles think they should also work on the roads themselves. The warden of the Joliet prison is strongly opposed to the project.



# CIVIC BEAUTY

## Effect of Parks and Playgrounds on Real Estate Valuation

The great movement towards civic betterment which has during the last decade occupied more and more of the attention of municipalities, has in America unquestionably taken as its central idea the acquirement of land and its development for park purposes. Many of the so-called city plans are devoted well-nigh exclusively to the discussion of a park system, while some go further to include only the civic center, overlooking the essential factors of utilitarian nature, which without expense to art should have to do with fostering health, convenience and happiness on the part of the inhabitants, economy, dignity and system on the part of improvements, and conservation in the broadest sense in regard to industries.

Municipalities must face the fact that they have to provide in advance, facilities for well-ordered play and recreation on the part of both old and young, as they would provide for streets and sewers, for police and fire departments. If such provision is made in a comprehensive and systematic manner, it is obvious that great and unnecessary expense will be saved, that parks will be located more correctly as to topography and accessibility, will serve all parts of the city and will aid the city in the broadest and most logical way.

Such provision in advance would at once obviate the danger of criticism in regard to undue interest on the part of real estate owners whenever the time for action for securing park land should arrive.

### Parks Enhance Value of Property

The enhancement in the value of real estate due to the establishment of parks, parkways or similar improvements made nearby, has many interesting illustrations. Observation will show that the realization of this fact has led numberless real estate owners eagerly to take up land contiguous to or adjacent to proposed improvements of this sort. Many out-of-the-way places previously occupying but an obscure place in the real estate market, have jumped to well nigh fabulous prices at the advent of a park in the neighborhood.

In innumerable instances, it is found that land skillfully treated by landscape architects has been made to sell at prices far beyond that boasting only of the ordinary and stereotyped class of improvements. While it is only natural to look for the finest residences on old established parkways, it is interesting to note the rapidity of high-class development brought about in hitherto cheaper sections of the city by the installation of well-developed landscape improvements.

### Minneapolis Values Rise a Thousand Per Cent

Some five years ago the park commissioners of Minneapolis began undertaking the reclaiming of land around the shores of the Lake of Isles, deepening the lake and causing the surrounding land to become high and well drained. At that time, building lots occupying the rise of ground overlooking the lake were selling at from $400 to $1,000 each. These same lots are selling today at from $4,000 to $6,000 each. During these five years there has been a marked increase in real estate values over the entire city, but nothing to compare with this instance, plainly showing that these improvements are responsible for the advance.

An instance in Ft. Wayne is an interesting illustration. A certain lot located opposite a then unimproved park was in 1911 sold for $750. Three months thereafter it was resold at an advance of $100. During 1912 the park was improved and in May of this year, this lot was again sold for $1,250, the former owner assuming assessments against the lot amounting to $30, which took care of his proportion of a $15,000 fund, raised by special assessment for the development of the park.

A statement issued by the park department of Seattle, Wash., shows that real estate values on property abutting upon or adjacent to park improvements have

increased from 25 to 40 per cent above land not similarly situated.

### St. Paul Four Hundred Per Cent Increase

From St. Paul comes the word that real estate values adjacent to parks have increased five times in value since the parks were established and partially improved. The lots on Lexington parkway have increased 300 per cent, the lots on River boulevard more than 500 per cent and on Wheelock parkway, not completed, the increase has been 100 per cent.

The annual report of the Kansas City park board for 1910, bears the statement that on Benton boulevard, upon which the abutting property has responded in a less degree in increments of value than on any other boulevard in the city, it is shown conclusively that the increase in value has been more than 183 per cent since the establishment of the boulevard and that after deducting the cost to the property owner of every class of improvements with which this frontage has been assessed, and deducting also the average increase of land values thruout the entire district, which includes increments due to this and other park improvements in the same district, there has been a clear net profit, demonstrably due to the boulevard, of approximately 44 per cent. Upon other boulevards, notably Armour, Gladstone, Linwood, Gilham Road and the Paseo, the gain has been from 200 to 500 per cent, the greater portion of it being directly attributable to the establishment of the boulevards.

### Chicago Reports Nine Hundred Per Cent Increase

A case in point in Chicago is especially interesting. A section of the North Shore, constituting some twenty acres was in 1902 held at $200,000 and was in line for purchase for development as a public park. Later on, however, it was decided to build a park by reclaiming the submerged shallows of the lake along the frontage of the property. In 1906, after these improvements were nearly completed, this same twenty acres was held at a price amounting to $2,000,000, which constituted more than the cost of the improvements.

### Profits on Excess Condemnation Revert to People

To such extent, in fact, have increases in real estate valuation been due to park improvement, that excess condemnation laws have been repeatedly enacted in Europe and to some extent in the United States.

Oklahoma City, operating under such a law took occasion to issue bonds for $400,000 for the purchase of land for park purposes. A tract of 1,500 acres was acquired, a portion of this deemed sufficient for park purposes was set aside and the remainder was cut up into building lots and sold. Out of an investment of $15,000, in two years the sum of $36,000 was realized.

Without going into details of various statutes relative to excess condemnation, it may be seen that thereby a community is safeguarded against the operation of land sharks and that returns due to tax investments are caused to revert directly to the property holder. By such methods, park improvements, if wisely undertaken, may be made without cost to the city.

In Germany, where it has long been customary for municipalities to own and control land, many cities, notably Berlin, Vienna and Frankfort, own from one-third to one-half of their entire municipal area.

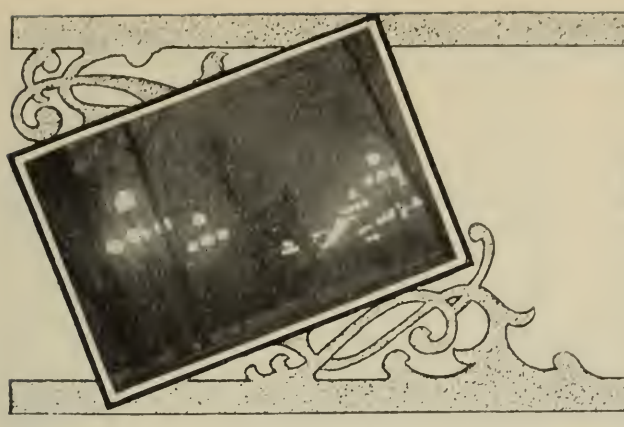
The exorbitant prices charged for business frontage along the principal avenues and boulevards of Paris, Berlin and London, demonstrate full well the advantages due to these features.

It has been stated that when a park fronts on a street devoted to retail business, the effect upon the business side of the street is depreciating, owing to the lessened number of poeple drawn to the district. In the instance of Michigan avenue, Chicago, that part which fronts on Grant park is fast becoming one of the most popular and attractive real estate sections of the city.

### Philadelphia City Tax Funds Profit at Once

In Philadelphia, where a magnificent parkway some 250 feet wide is being opened between the city hall and Fairmount park, a distance of one and one-quarter miles, it has been estimated that property on streets intersecting with the main parkway and extending for a distance of 300 feet in either direction, together with property facing directly on the proposed improvement, will be enhanced in value from $10 to $50 per foot, forming an aggregate increment which when capitalized at 5 per cent would make over $14,000,000 in new values. Upon this value at the present tax rate of $1.50, $210,000 would be produced, which is interest upon a trifle less than $8,000,000 of city loan at 3 per cent. This sum being in excess of charges assessed, a revenue will accrue to the city immediately.

A most striking example of success due to excess condemnation related to business streets of the boulevard type, is Northumberland avenue, London, where the amount realized by the disposal of surplus land exceeded the cost of the improvements by 119,000 pounds, about $550,000.



# Fire and Water

## Chlorine or Hypochlorites for Sterilizing Water

In a brief articles prepared for the English *Surveyor and Municipal Engineer*, Eric K. Rideal states his reasons as a chemist for prefering hypochlorite of lime or magnesium to chlorine for sterlizing water:

At the present time, when many waters are being treated with electrolytic bleach, with bleaching powder, or with magnesium hypochlorites, in order to produce a sterile water supply, it is important to investigate whether the purifying agency of the added substance is chlorine or not. For if it is chlorine that is the potent germicide in the water we have at first to investigate the action of dilute chlorine water on the human system, for which the water is intended, and, secondly, to discuss whether chlorine gas *per se* would not be a more economical form of treatment.

Pettenkofer and Lehmann say that 1 to 5 parts of "free" chlorine per 100,000 parts of air affect the respiratory organs, while 6 parts per 10,000 soon prove fatal. Koch also spoke firmly against the use of free chlorine, showing that it was poisonous in a similar manner to bromine and iodine, two other well-known halogens.

Various authors from time to time have shown that chlorine itself in the gaseous state forms only a fair disinfecting or sterlizing medium, while solutions of bleach are comparatively strong, strengths such as 1 to 5 parts of "available" chlorine per 1;000,000 usually sufficing to sterilise contaminated waters. The differences noticed between these two "chlorine" disinfectants are accounted for by their different mode of working. The action of chlorine on water containing traces of organic matter and also organisms is threefold.

A part of the chlorine attacks the organic matter and liberates substituted chloramines; these, as my father has shown, are very strong germicides, and are consequently of great utility in the water. Some of the chlorine acts directly on the organisms as a toxic agent, while the greater part of the chlorine (in the case of a water that does not contain large quantities of organic matter) is only slowly decomposed by the water into hydrochloric and hypochlorous acids. This occurs more rapidly under the influence of light.

Since hydrochloric acid is a strong acid, it will replace the carbonic acid in the carbonates that are probably already present in the water, setting free carbonic acid at the same time. If, on the other hand, the quantity of carbonates in the water is low, such as is the case in very soft waters, the hydrochloric acid formed by the chlorine will give the water a marked acidity, which, in the course of time, will affect the water conduits and pipes. The hypochlorous acid remains free and liberates oxygen when in contact with organic matter.

This hypochlorous acid is a strong disinfectant and steriliser, it possesses the advantage shared only by ozone and the peroxides (including nascent hydrogen peroxide liberated from the "per" salts) —namely, that it only liberates oxygen in the nascent state.

In the case of hyopchlorites, such as bleaching powder or electrolytic hypochlorites of sodium or magnesium, the only salts in solution are, firstly, neutral chlorides, that at such dilutions possess no physiological action whatever. The effect of adding calcium or magnesium hypochlorites to a hard water will be merely to increase slightly the hardness of that water. This may be obviated by using electrolytic sodium hypochlorite, which will not increase the hardness, but, in certain cases, will, in fact, soften it.

Secondly, calcium or sodium hypochlorite; these, if treated with strong acids, will liberate chlorine, which, as has already been shown, possesses marked toxic properties. If, however, they are treated with dilute weak acids (such as carbonic or humic), they liberate hypochlorous acid. This substance will sterilise the water by means of its oxygen liberating capacity. Thus, sterilising

by hypochlorites in normal waters, which contain free carbonic acid, is equivalent to sterilising by means of oxygen; the mere traces of chlorine that may be evolved are at once fixed by the substituted ammonias of the organic matter to form chloramines. There is at no time in the water a large quantity of free chlorine, as is the case in waters which have been treated with chlorine water.

Again, it is to be remembered, when the suggestion of treating water supplies with chlorine or hypochlorites is made, that one has to face the possibility of an overdose occurring thru some accident or neglect. In the case of the chlorine treatment, the effect might prove disastrous, while with hypochlorites a slight increase in the salinity of the water would be the only result.

Another point in favor of the hypochlorite treatment, whether the hypochlorites of sodium, magnesium or calcium be used, is that the crude chemicals do not exert that powerful destructive effect both on the human system and on the vessels with which they come in contact, which is the characteristic of the halogens. Very special precautions, indeed, would be required if liquid chlorine in bombs were to be used as a disinfectant for water or effluents.

Although the price of chlorine falls considerably below the market value of any form of hypochlorites, from these considerations it may be perceived that the employment of free chlorine for water supplies has its grave disadvantages, which are not shared by the hypochlorite treatment.

## A Municipal Watch Tower

Thirty years ago the city of Indianapolis established in its court house tower watchmen whose sole duty it was to scan the city night and day for fires which had not yet been discovered by the occupants of the property affected.

On the fourth night after his first "trick," Frank W. Graham, who has been in charge of the tower since this auxiliary method of detecting fires originated, turned in an alarm on a blaze that was not known to have started until the fire department arrived. A continual demonstration of efficiency caused the city to install very soon a twenty-four-hour watch, which has continued for practically thirty years.

The growth of the city and the erection of numerous tall buildings has made it imperative to locate this branch of the service at a higher point. It now occupies a tower 280 feet above the street, from which it is possible to view the entire city and surrounding country for a radius of twenty miles with an unobstructed view. With the aid of powerful binoculars the character of a fire can be quickly discerned, whether it be the burning of a rubbish heap or a small blaze under the eaves of a roof. This method of observation has saved property owners many thousands of dollars and in a number of instances has been the means of preventing serious conflagrations in congested and highly inflammable districts.

The watchmen work in three shifts and are in constant communication with the fire-alarm telegraph system by means of directly connected telephone service.

The thorough familiarity of the watchers with the city, the use of carefully drawn maps and instant means of communication all tend to facilitate very greatly the work of the department, as well as to increase materially the efficient safeguarding of property.

The police department has installed a powerful searchlight, which can be directed in any direction, for the purpose of testing it as a means for signalling to policemen on their beats and directing a light upon any point desired. The chief of police is quite sanguine of its success and if his expectations are realized it may not be necessary to extend a police signallight system thruout the city. The expense of such a system has thus far prevented its adoption, altho it is much needed, and the possibilities of the searchlight will be thoroly tested.

## Temporary Track Construction Causes Water Main Electrolysis

An unusual damage suit was brought against the Pacific Electric Railway company in the city of Los Angeles recently by the public service commission, charging the company with damage to the city's water mains to the extent of $42,500, by allowing electrical current to disintegrate the pipes.

The railway company admitted its liability, the case was settled by arbitration and the amount paid in full.

The damage was caused when the railway company put in a temporary system along Sunset boulevard, while the old narrow-gage tracks were being replaced by standard gage. The temporary rails were not bonded together and the electrical currents escaped into the ground.

When the water was turned on in the city's 42-inch water main, which paralleled this track, it was found that the electric current had deteriorated the pipes, making them useless. Engineers made a special investigation and it was found that the damage was caused by electrolysis and the pipes had to be replaced at the expense of the Pacific Electric company.

# Organizations and Individuals

## New Municipal Newspaper

"Telling the stockholders of that corporation known as the city of Los Angeles how their affairs are being managed," thus does Robert E. Rhinehart, managing editor of that unique publication the "Municipal News," characterize the object of a distinctly municipal newspaper.

Eliminate telegraphic news, scandal, accidents, society, sports, the comic supplement and many other features that are so prominent in the privately owned newspapers, and you have just a glimmering idea of the "Municipal News." The people of Los Angeles pay $36,000 a year for it in order that they may be intelligently informed on how their taxes are being spent.

Last year the people voted that they should be kept constantly informed, from an unbiased viewpoint, of the administration of their taxes, and of how their city solons were proposing to govern them by ordinances. Today 60,000 people have delivered at their doors each week important facts about the city hall.

It is Mr. Rhinehart's duty to put the "spotlight" on the various city departments, informing the people of what is being spent and what planned, and of ordinances that are pending, with discussions of both the advantages and disadvantages of such proposed city laws. In a community which has the power of the initiative, referendum and recall these discussions are particularly valuable, as many questions come to a popular vote and must be carefully studied by the voting public. Both sides of questions are presented in parallel columns in order that each may be properly considered. The same method is pursued in giving space to political parties, of which there are five. One column is allotted to each in every issue, the matter being prepared by the party committee.

Every effort is being made to make the paper self-sustaining. Mr. Rhinehart's wide experience in the newspaper field has enabled him to lay down a broad and comprehensive business as well as editorial policy. The merchants of Los Angeles are giving their strong support in form of advertising. The standard set is of the very highest. Any advertising of the least immoral or fraudulent tendency is barred. Its pages are closed to patent medicine, clairvoyants, loan sharks, quack doctors, saloons and the like. The receipts from advertising are used to increase the circulation, number of pages, illustrations and feature articles.

*Robert E. Rinehart, Editor of Los Angeles Municipal Newspaper.*

Mr. Rhinehart is a young man, only 34 years old, but a veteran in the newspaper, magazine and publicity professions. He is a graduate of Princeton (1904), and was for some time on the editorial staff of the New York Sun, with the Scripps papers in California, and editor of a magazine published by Bobbs-Merrill Company of Indianapolis.

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## Technical Associations

The ninth convention of the American Wood Preservers' Association was held in Chicago, January 21, 22, 23. The subjects discussed included preservatives, plant operation, various forms of timber and paving blocks, a session being devoted to each class of subjects. A number

of excellent papers were presented by the experts which compose this progressive society. F. J. Angier, Mt. Royal, Baltimore, Md., is secretary.

At the annual meeting of the municipal engineers of the city of New York, James W. Nelson, president of the Brooklyn Engineers' Club, gave an illustrated lecture on the Panama Canal. George A. Taber, secretary, 29 West Thirty-ninth street.

The fourth annual meeting of the American Society of Engineering Contractors was held on January 14, in New York city. The principal papers presented were one on "Legal Hints to Contractors," by William L. Bowman, civil engineer and attorney at law, and one on "Fire, Its Effects and Prevention," by Edward F. Croker, former chief of the New York fire department, now president of the Croker National Fire Prevention Engineering Company.

The sixth annual Chicago cement show, held Jauary 16 to 23, was as successful as its predecessors. Motion pictures of the Wayne county roads, out of Detroit, Mich., were a novelty. So was the "paving determinator" for making practical wearing tests of paved surfaces.

The annual meeting of the New England Water Works Association was held in Boston, January 8. The morning session and part of the afternoon session were devoted to reports of committees. Papers were presented by Charles W. Sherman on "Experience wth Water Rams," and by Robert J. Thomas, superintendent, on "The Water Works of Lowell and Some Recent Improvements." Willard Kent, secretary, Narragansett Pier, R. I.

The National Civic Federation held its annual meeting in New York, January 28 to 29. The principal questions discussed were more mediation in industrial disputes, regulation of public utilities, workmen's compensation, pensions for employes, reform in legal procedure. Ralph M. Easley, Metropolitan Tower, New York city, is chairman of the executive council.

## Civil Service Examinations

The United States Civil Service Commission will hold examinations at the usual places as follows:

February 24—Petroleum engineer to investigate oil and gas wells and transportation facilities, at $2,000 to $3,600 a year.

February 26, 27—Assistant irrigation engineer, office of experiment stations, Department of Agriculture, for service in the field, at $1,200 to $1,600 a year.

March 12—Aids and computers in United States Coast and Geodetic Survey; assistant engineer and junior engineer, reclamation service; computers, architectural draftsmen, engineers, heating and ventilating engineers, junior architectural draftsmen in supervising architect's office; topographic draftsmen and coypist topographic draftsmen in departmental service; junior engineer in engineer department at large; forest assistant in forest service; forest assistant in Philippine service; superintendent of construction.

April 9—Aid, cadet engineer, cadet officer in lighthouse service; computer in nautical almanac office and naval observatory; mechanical and topographic draftsmen in Isthmian Canal service; engineer, Indian service; junior civil engineer, junior mechanical or electrical engineer, in engineer department at large; junior mining engineer, in bureau of mines; surveyor in Philippine service; assistant examiner in patent office; assistant observer, civil engineer and draftsman, civil engineer and superintendent of construction, civil engineer student.

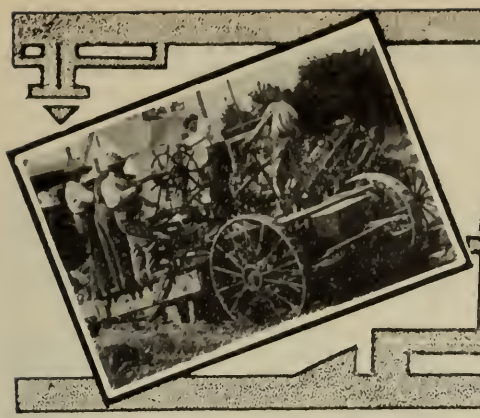
## Personal Notes

J. E. Pennybacker, secretary of the American Highway Association, has been selected as statistician to the joint congressional committee on Federal aid in the construction of post roads. He retains his position in the association, the work being in the same line. His work on the association's year book is largely responsible for his selection by the committee. An exhaustive study of foreign and American road systems will be made under the energetic supervision of Hon. Jonathan Bourne, Jr., the efficient chairman of the committee.

George F. Swain, professor of civil engineering at Harvard University and for many years head of the civil engineering department at the Massachusetts Institute of Technology, was elected president of the American Society of Civil Engineers on January 15.

Godfrey Sperling, who has been engaged in civil engineering practice for seven years in the Overland building, has removed his offices to the Shaw building, Boise, Idaho.

W. P. Fowler, for several years city engineer and county surveyor at Wabash, Ind., has gone to Meridian, Miss., where he will act as city engineer.



# MACHINERY AND SUPPLIES

## A Modern Pumping Engine

*By C. F. Croner, Captain, Fire Department, Eugene, Ore.*

The city of Eugene has taken successfully its first step in motorizing its fire fighting apparatus. The Nott combination pumping engine added to the Eugene fire department, August 12, has proved a good investment for the city in the reduction of 5 per cent in insurance rates, and more especially in the service it has rendered in the fires there have been in the months since its purchase. This machine pumps 760 gallons of water per minute, has a 40-foot extension ladder, carries 1,500 feet of hose, also a 60-gallon chemical tank and runs at a speed of 40 miles per hour.

Our mayor, F. J. Berger, witnessed the test of this engine at Portland, Ore., on July 25, 1912, and his observations resulted in its purchase.

All of the gage readings were made by Capt. Dolson and Master Mechanic Phillips, of the Portland fire department, using their standard fire department nozzles and their own pressure gages. The engine delivered thru two 250-foot lines of 2½-inch hose, with 1⅛-inch nozzles 626 gallons, holding 70 pounds on each nozzle; drawing water from a cistern eight feet. The engine was taken to Salem, Albany, Corvallis and Independence and then to Eugene and demonstrations were made in all these places. On the official test at Eugene with two 200-foot lines drawing water eight and nine feet, with 1⅛-inch nozzles, it delivered 650 gallons, holding strong 75 and 80 pounds on the nozzle and from 130 to 135 pounds on the pump. After driving this machine 96 miles over rough country roads and demonstrating it in various cities, every part of the machine was found to be in perfect working order.

*Nott Pumping Engine.*

We are proud of our auto combination motor pumping engine. It is a very efficient fire fighter and its mechanical features appealed to us from the start.

The chemical tank is very neatly placed under the rear axles and under the hose box, being out of the way, and it runs on a steel track with rollers. With one finger it can be pulled up for operation and reloading and after service shoved back and automatically locked in position. The hose wagon carries from fourteen to fifteen hundred feet of hose, with the rest of the paraphernalia commonly used for fire department hose wagon, and has ample room for ten to twelve men.

The machine has been called to fires at a considerable distance from the central station and has made most excellent time. Paved streets reaching every section of the city make it possible to travel at the maximum speed even in the rainiest weather. Especially was the machine useful on January 8, 1913, in gathering up from several hose houses the hose needed in a stubborn basement fire in a downtown block.

The machine is equipped with a four-cylinder engine, 5¾-inch bore by 8-inch stroke, and develops 100 horsepower by brake test, while the A. L. A. M. rating shows 53 horespower. The crank shaft is 3 inches in diameter with cone clutch 21 inches in diameter. The clutch weighs 400 pounds and acts as a flywheel. The engine is water cooled. The wheels are 42 inches in diameter with 6-inch rubber tires.

The comparative cost of the old system and the new cannot be given accurately, both because of the shortness of the time which the automobile has been in use, and also because of the changes in the manner of handling the department. With the horse-drawn hose wagon and chemical, two men were employed at $75 and $60 a month, and volunteers were relied upon to do the greater part of the work.

The city council at its January meeting authorized the employment of three more paid men, so that at all times there will be enough men to go with the equipment to man it. The volunteer department has been disbanded.

Fire alarms are given through the city telephone system, and as there are 1,670 phones in the city, covering practically every block, it gives a very accurate system for the calling of the department. "Eugene fire department 1000" appears across the very top of the cover of the telephone directory, and we insist on knowing the exact location of a fire before starting and are thus enabled to go by the nearest streets direct to the fire, passing a hydrant on the way.

## Practical Playground Apparatus

*By Harold O. Berg, Supervisor of Recreation, Milwaukee Public Schools, Milwaukee, Wis.*

Our gymnasium outfits consist of inclined ladders and sliding poles, sliding chutes, vertical poles and ladders, flying rings, trapeze, teeter ladders and traveling rings.

Giant strides, swings, see-saws and slides are very popular in out-door playgrounds. Lawn swings seem to be the most popular with the little tots, while the giant strides strike the fancy of the older boys. Teeter ladders are popular with girls, but not with the boys. Taken in all, however, traveling rings are as popular as anything on the playground.

Our playgrounds are situated in the most congested sections of the city so as to afford playing and breathing space for the poorer classes of children, who, otherwise would have no place, aside from the street and alley, in which to play.

Altho parents are deeply appreciative of playground opportunities, they are exceedingly vindictive in case their children are injured while at play and for this reason we purchase steel playground and gymnasium apparatus. Our apparatus is very largely made up from standard galvanized pipe. The few wooden parts, such as see-saw boards, box swings, etc., have three coats of lead and oil paint, as this finish is considerably better for out doors than an oil and shellac finish. All the metal parts are galvanized. All the pipes which go into the ground rest on concrete foundations.

Our teeter ladders are 12 feet high. Each side is made of a piece of 2-inch galvanized pipe and the rungs are made of ¾-inch galvanized pipe. The rungs are let into the pipes which form the sides and are riveted thru. Nicely shaped iron hand-holds are fastened into the ends of the pipes which form the sides. The central pivoting casting is made suitable for a 3-inch perpendicular pipe support. The ladder is readily adjustable to any height. This is an important feature and in our opinion necessary for practical use. It permits of putting the ladder within easy reach, thus reducing the possibility of accidents.

Much time and money was spent experimenting with various forms of swings in an effort to produce something which would stand the severe use it is subjected to in the average playground. Rope supports required replacing from one to three times each year and the ropes stretched unevenly, making resplicing constantly necessary. Chain supports were an improvement over the ropes, but they did not permit of a firm grasp and cramped and pinched the children's hands. Our

swing is truly all steel, as even the seat is made of steel. The seat is pressed to correct shape and edges are rolled and turned underneath. The supports are made of ½-inch diameter drop-forged steel links. These links are drawn to make the diameter smaller at the ends than in the center, forming a shape particularly suited for the grasp of a child.

The playground apparatus used in the gymnasium and playgrounds of Milwaukee public schools is made by the Fred Medart Manufacturing Company of St. Louis, Mo.

## A Gasoline Pump for Park Use

The accompanying illustration shows a unique application of a small pumping engine, manufactured by Fuller and Johnson Manufacturing Company, Madison, Wis. The engine, attached to an ordinary portable force pump, is used for sprinkling parks, lawns and for pumping water to various parts of public parks, where water from the city supply may not be available. Several cities thruout the country have purchased these pumping engines for use in public parks and have found them so generally satisfactory that the practice will undoubtedly extend to other cities thruout the country.

*Fuller & Johnson's pumping outfit in use in park system.*

The engine was designed originally for general farm purposes and its general utility for such work makes it particularly adaptable to the purpose above mentioned. The engine is a vertical, single-cylinder, four-cycle gasoline motor, having a cylinder 3½x3½ inches with a speed of 500 to 600 revolutions per minute. It is air-cooled and has a gravity oiling system which enables it to stand extremes of temperature under high duty without reduction of efficiency. The carbureter is supplied with an automatic damper valve for shutting off the air when starting. This insures the rich mixture needed to start the engine at once, even in zero weather. The engine complete with battery box, ignition coil and batteries weighs about 280 pounds. It is sold f. o. b., Madison, Wis., at a price of $70. The manufacturers will supply upon request a complete catalogue showing the various use to which this unique gasoline motor is adapted.

## "Everwear" Playground Apparatus

The quality of apparatus selected for playgrounds is a potential factor in their success or failure. As the development of playground work becomes more effective and thoro, the use and strain to which equipment is put becomes more and more severe. Playground equipment must, in fact, not only withstand hard use, it must withstand abuse and must give good service under the worst conditions of heat and dust. It must also be durable, simple and safe.

The Everwear Manufacturing Company, Springfield, Ohio, has placed on the market a series of all-steel, galvanized play outfits which covers all kinds and styles of apparatus necessary or desirable for public playground use. The outfits are sold under a guarantee covering materials, workmanship, durability and maintenance costs.

The fittings of special heavy galvanized wrought iron are made tubular to admit of use on standard sizes of galvanized wrought pipe and are equipped with compression shoulder bolts or set screws instead of threads. The shoulder bolt is recommended and used for fastening all top runs, thereby providing perfect rigidity and safety. All swings and swing outfits are equipped with forged steel link suspensions with a roller bearing clamp attachment providing the greatest pos-

*Everwear Playground Equipment.*

sible freedom of action. The "giant strides" and similar devices are equipped with ball bearing heads.

An attractive illustrated catalogue H-2 gives complete descriptions and prices of the entire line of equipment and the various combination outfits offered. The combinations are designed to meet the fullest requirements for any size playground desired.

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## New Use for Diaphragm Pumping Engine

During the last year the owners of tanneries have tested out the value of the Atlantic diaphragm pumping engine for pumping out tannery vats and other purposes in their business. Formerly they have resorted to the usual hand pump, requiring anywhere from 3 to 8 men to handle it, which has made the labor cost high. Last year they began to experiment with the Atlantic pumping engine and have been greatly surprised and pleased to find that expense could be reduced most decidedly.

The Atlantic diaphragm pumping engine is built on such correct constructive principles that it requires no attention, except the filling occasionally of the oil cups, for 24 hours a day. The Atlantic engine can be attached to various kinds of pumps to suit special kind of work, in fact, it can be attached to the hand pumps contractors may now own.

Each engine is thoroly tested before shipment and a record is kept of its brake h. p. delivery. The whole outfit is attached to a channel iron frame, mounted on low cast iron wheels with swivel front axle and drawing handle and can be wheeled around on the ground by one man. The batteries, coil and starting switch are in a battery box. The electrical equipment consists of six best quality dry batteries and a first-class jump spark coil in connection with a reliable mica spark plug. The gasoline tank has a capacity of one gallon, which is sufficient for operating the pump for 8 hours.

The mechanical points of the engine may interest our readers. The engine is 3½-inch bore, 3½-inch stroke, normal speed 500 revolutions per minute, but the speed may be changed while the engine is running to vary from 300 to 700 r. p. m. without injury to any of its parts. This gives a speed to the pump of from 30 to 40 strokes, as may be desired. The engine has a capacity of 3,500 gallons per hour. Fly wheel is 14 inches in diameter. Jump spark ignition, special generator valve and everything necessary to make a perfect engine. All gears have cut teeth. Pinion of steel and the cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frost proof and no serious damage can follow, even tho water should freeze in the water jacket.

The engine is provided with a special and original speed regulating device which operates on the governor by increasing the tension of the spring on the governor weight and at the same time advancing the timing of the spark. The gears and levers are mounted between two plates, so that there is no overhang or side pull, which is the case when these parts are mounted on studs screwed into side of engine frame. The adjustment of the engine is such that the pull on the brake beam of the pump is in exact pro-

portion to the increase or decrease of speed, and the engine consumes current from the batteries in exact step with the horsepower delivered. The connecting rod is of steel and carefully babbitted. Every part of the engine is made to template, insuring interchangeability of parts.

## Resurfacing of Streets

*By R. M. Davis, President, Metropolitan Paving Company, St. Joseph, Mo.*

During the past three years we have re-surfaced 35,000 square yards of pavement for the city of St. Joseph and have now 25,000 square yards of re-surfacing under contract. This re-surfacing of old brick, stone and asphalt pavements has been uniformly successful from the standpoint of economy as well as durability.

Old pavements can be re-surfaced with a 2-inch asphalt top at an average cost of $1.50 per square yard, and after this re-surfacing is done you have, in my estimation, a much stronger pavement than the original. A properly re-surfaced pavement is stronger than a new pavement because you have really a double base.

In re-surfacing we fill ordinary depressions with asphalt binder and cushion, but we re-lay in case of a big depression.

The machine which we use in this work is the Lutz surface heater, made by the Equitable Asphalt Maintenance Company of Kansas City, Mo.

The Lutz method consists in drawing a large volume of air, heated to a proper temperature, from a heating chamber and blowing it with great force upon the asphalt or other bituminous pavement, thereby gently heating and softening, without flame, the old pavement to the same consistency as the new material. Then, with the use of hoe and rake, all disintegrated materials, uneven or worn surfaces are removed and joints cut, while the pavement is still hot, sufficient new material to bring up the grade and contour of the street is added. The temperature of both materials being at vulcanizing point, when tamped, smoothed and rolled, a perfect weld is produced, leaving a finished surface. Instead of having a "patch," the repair becomes a part of the whole.

In re-surfacing brick or stone pavements, the old pavement is first thoroly cleaned and is then heated gently with a continuous blast of heated air from the Lutz machine. No flame is permitted to come in contact with the pavement to overheat or burst any part thereof. Under this heat the pores of the brick or stone are opened, and while in this heated state it is painted with a hot liquid asphalt. After the pavement has been cooled, the pores being closed, the new asphalt mixture is applied, which makes a perfect adhesion.

*Lutz Surface Heater in Use.*

## The Making of Street Signs

*By F. M. Burdick, of the Burdick Enamel Sign Company, Chicago, Ill.*

The question has been raised as to the reasons why the great majority of municipalities in ordering enamel street signs specify white letters on a blue background.

This point, as well as several other important features established in the manufacturing of enameled signs, is thoroly covered in the following communication from Mr. F. M. Burdick, president and treasurer, of the Burdick Enamel Sign Company, Chicago.

"The white letter on a blue background is conspicuous," writes Mr. Burdick, "and this color combination is harmonious and very readily read either in daylight or by electric or gas light. These colors do not show dust or dirt as readily as others.

"We use English charcoal rolled iron, No. 18, United States standard sheet-metal gage, in the manufacture of our signs because it is practically free from imperfections such as blisters, scale and other foreign substance, which are detrimental to enameling. The advantages of iron over steel are due to the fact that the iron is fibrous, open and porous, which when heated, allows the enamel to become thoroly impregnated with the metal base, which in turn, makes a more durable sign, on account of the porous nature of the iron. Bessemer, or open-hearth steel, is not porous, consequently the enamel can not deeply imbed itself in the body of the metal, as is the case with the iron sheets. The enamel merely clings to the surface of a steel base and will readily scale off, and when the enamel does scale, the steel base is exposed to the elements and readily corrodes, which in turn, undermines the balance of the enamel plate and causes the enamel to readily fall off and disappear.

"The reason why we use five coats of enamel in the making of our street signs is because our enamels are very hard,

which in turn makes them more durable and better able to resist the elements. The fluxes are reduced to a minimum. With our hard enamels it is necessary to apply them thinly and apply one coat after another until we get the desired finish. That is why five coats of enamel are required to make our signs.

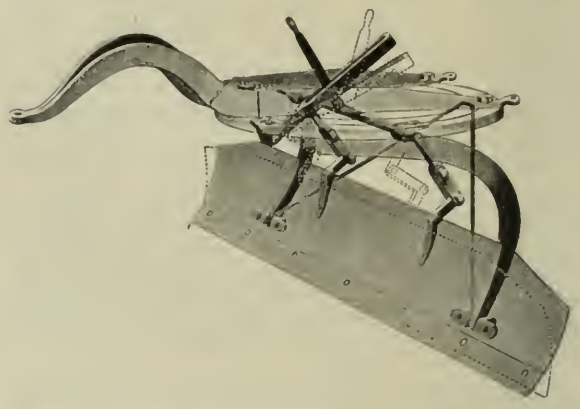
"Our vitreous porcelain enamel, we claim, is better than other enamels for the reason that it is harder enamel. The acids of the air that the signs are naturally exposed to when put out doors will in time affect the soft enamel. We use the hardest kind of enamel that we can obtain. This enamel costs considerably more than the cheap enamel, but is better in every respect. Softer enamels can be applied heavier and thus reduce the number of coats, which are necessary to apply to produce a finished sign, which in turn reduces the amount of labor required and the amount of fuel consumed in the enameling, but with the reduction of the fluxes, their wearing qualities are also greatly reduced, which causes the finished sign to rapidly deteriorate and fade when subject to atmospheric conditions.

"We fuse our enamel at 1800 deg. F., because it cannot be fused at a less heat, as the enamels are so hard and the flux is reduced to such a low point that they cannot be properly fused at a less heat than 1800 degrees F., while the enamels on the cheaper signs contain so much flux that they will readily fuse at 1000 to 1200 degrees F."

## Labor Saving Machinery

"Roads are not temporary," states one of the leading contractors of Omaha, Neb. "When one is built it is intended to be used until worn out and it is manifestly to the township's, county's or municipality's interest to build the kind which gives the best results at the least annual cost, and do not overlook the fact that first cost plays an important role on arriving at the annual cost. The first cost is most seriously considered by the letter of the contract as well as the bidding contractors. The contractor, in self protection, must figure on the use of labor-saving machinery of the most advanced types because the more manual labor he can save the better his chance of landing the contract. Man and horse-labor is a scarce and expensive article during many months of the road-building season, and it pays the contractors to eliminate both as far as possible. Those contractors who make the most extensive use of labor-saving equipment, and thereby reduce their costs, are the contractors who not only land the most contracts, but who turn out the best work.

"Each road has its own peculiarly difficult problems and the machines most economically efficient are those machines which most readily adapt themselves to the greatest number of these problems which bob up on every piece of road-building construction. To illustrate, permit me to state that we find that the Western Reversible or Blade Grader readily adapts itself for either leveling or finishing off embankments or for making ditches in cuts. This machine cuts into banks at an exceedingly short angle and can be operated by one man, besides the driver. It does the work of some machines requiring many men and thus effects a considerable saving. The Western Special Reversible Road Machine is a type which is built extra heavy and is equally suited for stumpy or rooty or strong ground. This machine, while of draft heavy enough to withstand the roughest propositions encountered in difficult road work is not so heavy but that



*Tilting arrangement showing blade, gooseneck and circles of the "Western Reversible Road Machine and Ditcher."*

it can be used on ordinary work and really takes the place of two machines.

"Time is one of the most important elements entering into road-building contracts. I cite this fact inasmuch as a contractor is oftentimes obliged to crowd the work night and day. He does not always have time to wait for new machinery and it is a relief to have in operation a type of machine to which he can add two to four extra horses or a tractor and push it thru as fast as power can tear it. It pays to have a machine on the job which will stand such a strain without injury or breakage. The 'Western' has the advantages which will appeal to contractors, such as an absolutely direct drive as well as a special tilting arrangement for placing the blade at a position on the riding platform. The floating scraper blade does not dive or turn in and is always under the operator's control; it cuts smoothly and does not hold on an obstruction until its stops the source of power or breaks.

"No matter the position of the wheels,

the scraper blade remains in the same position and thus cuts evenly. This blade reverses and consequently the machine is easily reversed in standing position. It has a circle within a circle, thus making this reversing process simple and easy from a mechanical standpoint.

"The building of durable and well constructed highways is engaging the serious attention of state, municipal, county and township officials in all sections of the country. More large bond issues for such improvements will be floated in 1913 than in 1911 and 1912 combined and it behooves all contractors to so systematize their organizations that they will be in a position to handle large work at the right price. The right sort of labor-saving machinery gets contracts for the simple reason that it makes successful bidding possible."

The two machines described above are made by the Western Wheeled Scraper Company of Aurora, Ill.

## Cutting Mixing Costs

*By Bresse & Brown, Contractors, Mattoon, Ill.*

The automobile is bringing a demand for more smooth pavements.

It is surprising to note the number of taxpayers in our smaller towns who own automobiles, and, as a consequence, more pavements will be laid in the spring of 1913 than ever before.

Small towns and cities vie with one another in raising their mileage of paved streets. This demand for the maximum mileage of paving means that the contractor must make use of the latest perfected labor-saving machinery in order that his labor yield him a profit.

In our paving work at Shelbyville, Ill., as well as in all of similar work in 1912, we used a low charging mixer with cart charger, because by using a number of these cars, which are pulled from material piles onto the platform to dump, by means of a single cable hoist, we were enabled to cut out the expense of several men as well as to secure more rapid work.

This cart-charging mixer, which does away with the use of wheelbarrows for bringing the material from the piles to the drum, is made by the Standard Scale and Supply Company. Each of the several carts which we use have a full one-batch capacity.

The complete batch, including the gravel or stone, sand and cement, are placed in the carts on the ground level and the whole batch is pulled from the material piles onto the mixer platforms by the power that operates the mixer, and is ready to be charged into mixer as soon as the previous batch its discharged from the drum. With the carts there is no clogging and no necessity for pounding on the bottom, or using other methods to make the discharge clear.

The cart is then taken back by the man who guides it to the mixer and the rope is removed from the empty cart and attached to another loaded cart and the process is repeated.

The man operating the engine on gasoline outfits also operates the hoists and the automatic water tank, and it is not necessary to have a man on the mixer

*The "Standard" Mixer on street paving work, Shelbyville, Ill. Bresse & Brown, contractors.*

platform, consequently one workman less is required at the mixer.

For street intersection work a special rapid discharge arrangement is used so that the batch is discharged in two or three revolutions into carts which are generally used to take it away.

When using the "cart charger" the mixer can be used above the street level if desired so as to give a down grade for handling of the mixed concrete from the mixer to the forms, and the mixed concrete can then be handled in carts down a slight incline easily and quickly.

The mixer is moved forward as the work progresses by the cable used to draw the carts to the mixer, which can be attached to a telegraph pole, and the mixer pulled forward by its own power.

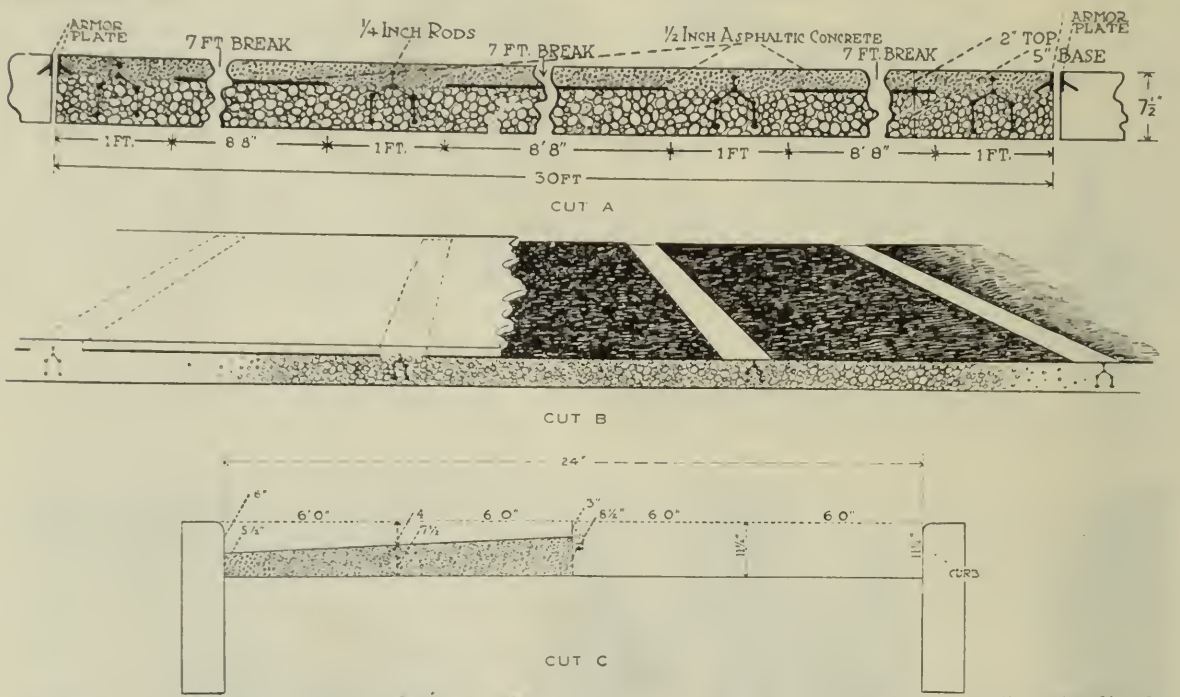
Our crew, which consists of seventeen men (six wheelbarrow men, thre mixture spreaders, two machine operators, two cart wheelers and four cart fillers), average one batch per minute or 1,000 square yards per day.

of a special soft steel, in bars 3-16-inch by 2½-inch, shaped to conform to the crown of the pavement and provided with shear members that tie them securely to the concrete top and wearing surface.

These plates have been in use for experimental purposes for a period of six years, and in general use in Wayne county roads during a period of four years and they have absolutely overcome the one difficulty that threatened the ultimate success of concrete road construction.

Various bituminous preparations, tar paper, asphalt felt, plank, wood block, vitrified brick, etc., which have at times been utilized for joint filler and protection, have proven hopelessly inadequate and have in no case afforded more than merely temporary benefit.

The most pleasing feature of the year's work is the fact that builders everywhere have almost invariably exhibited an earnest desire to obtain the best possible results. This presages well for the future of the concrete pavement.




*Baker Steel Armor Plates, Showing Method of Placing to Prevent Both Longitudinal and Transverse Cracks.*

## Armored Concrete Pavements

*By R. D. Baker, of the R. D. Baker Co., Contractors, Detroit, Mich.*

In 1906, noting that in the few isolated instances where pavements of the concrete type had been previously constructed, the constant jar of heavy traffic and the blows of hoofs against the unprotected edges of the expansion joints, had invariably resulted in a steadily increasing abrasion, which eventually produced an unsightly rut, annoying to traffic and extremely difficult of repair, I designed a steel armor plate for the protection of expansion joints. These plates are made

Any form of pavement with a solid, unyielding surface is subjected to a greater degree of wear if the surface is uneven than when it is free from depressions and irregularities. The pound and jar of traffic is in direct proportion to the surface roughness, and where the irregularities are pronounced, will inevitably result in the gradual disintegration of the pavement.

Roughness is also a source of severe annoyance to traffic. It means a very perceptible loss of comfort, and places an entirely unnecessary strain upon the passing vehicles. In these days of the automobile, when speed in travel has arrived

at a maximum, this fact is brought home with greater force than at any time in the past, and the loss occasioned by uneven road surface is tremendous.

As shown in Cuts A and B, reinforcement is placed at points where base and wearing surface unite. These rods are placed to prevent longitudinal cracks, which are apt to appear in pavements not reinforced. They also serve to tie surfacing to base when resurfacing.

In several hundred square yards of concrete paving where joints have been placed 25 feet apart no liability to transverse cracks extending from curb to curb was found. For this reason no necessity to reinforce longitudinally is felt.

As an additional precaution against longitudinal cracks, cross section for pavement as shown in Cut C is used.

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## Pumping Water for Road Work

"Water in sufficient quantities to meet our requirements is not often available in the country districts without some device for carrying it," states Edward N. Hines, of the board of county road commissioners of Wayne county, Michigan. "Hauling it by teams at $5 per day each is an expensive proposition, especially where a single crew, when under full swing, uses about 15,000 gallons a day. To meet this situation pipe lines are laid to the nearest supply, which lines, where they run along our work, are tapped every 300 feet, so that a supply may be available at any point. Fairbanks-Morse 3-h. p. gasoline engines are used to force it to the work. We have pumped water out of the River Rouge a distance of six miles. At least eight teams would have been necessary to do the same work.

"Whenever possible, we use machinery in our work and we find that pumping water for miles is considerably more economical than the hauling of same by wagon. It is not an unusual spectacle to see the large hauling engines of the commission trailing two to four large wagons, each loaded with 7 tons of stone. Graders are also drawn by steam, doing the work of from 6 to 8 horses, and doing it more efficiently and more rapidly. Old roads are rooted up with a scarifier or gang plow. Stone and sand on some of the roads are unloaded with a steam grab bucket, and many smaller economical and labor-saving devices, designed by the commission or its employes, are in use. Cement is mixed in a mechanical batch mixer that moves under its own power, and from which a boom projects, capable of being swung in the arc of a semicircle."

## Mixing Concrete for Pavements

*By F. P. Wilson, City Engineer, Mason City, Ia.*

In the construction of some of our most successful work a mechanical batch mixer with a 25-foot boom, on which there is a traveling bucket, was used, and this mixer is manufactured by the Koehring Machine Company of Milwaukee. After the sub-grade had been thoroly rolled the material was distributed along the street, the rock on one side and the sand on the other. The Koehring mixer was set up at the end of the street 25 feet from the place of beginning. In the first section 12½x30 feet, the concrete was placed. Immediately the wearing surface was placed upon the concrete, not to exceed 20 minutes elapsing between the time the concrete was placed and the wearing surface was placed on same. Then the next section of 12½x30 feet was put in. Then the mixer propelled itself backward 25 feet and proceeded as before.

Parallel with the curb and 10 feet out from the same the wearing surface was cut thru the concrete, these parallel cuts being 10 feet apart so that the actual blocks of concrete are only 12½x10 feet.

The contractor, Mr. George Gabler of Mason City, Iowa, writes: "My average yardage per day on a 30-foot street was 600 square yards. On a 40-foot street I increased this average to 700 yards per day. My best run was 720 yards, and was on a 40-foot street. All of my work was on two-mix work, that is, we laid a 5-inch base with a 2-inch top, which took almost twice as much time to put on as the base. On straight concrete base we could have doubled that.

"My gang consisted of 24 men, counting the water boy, and was distributed as follows: 4 cement finishers, 3 men setting forms, 1 man on odds and ends, 1 engineer, 1 fireman (this man also counted empty sacks, etc.), 1 man handling boom and bucket, 4 men wheeling rock, 3 men wheeling sand, 1 man handling cement, 3 men screening sand for topping, 1 water boy, 1 foreman.

"The above lineup I found to work to the best advantage for my work. I do not believe there is a concrete mixer that can begin to put in concrete paving as cheap and with as few men as I have done with the Koehring special street-paving mixer. The mixer has given excellent satisfaction. We have not had any trouble at all during the past season, having used it for eight months, ten hours per day, with not to exceed three days of lost time, all of which was caused by rainy weather. As to repairs, will say that there were none."

## The Thomas System of Reinforced Concrete Roads and Pavements

While the Thomas system of reinforcing concrete roads and pavements is patented it is stated on good authority that no advantage is taken by the company as to the price of the reinforcement, which is uniform to all contractors. "To give an idea of the price at which Thomas system reinforced concrete pavements may be laid," states Mr. F. P. Obennauer, president of the Thomas Steel Reinforcement Company of Detroit, Mich., "I will simply refer to the many square yards of this pavement laid in the vicinity of Detroit for about $1.35 per square yard and this includes a 5-inch course of concrete foundation and a 2-inch granite or crushed boulder smooth-wearing surface. This makes a saving of about $1 per front foot to the property owner, and as the cost of maintenance is practically nothing, also a reduction in the general tax. Miles of this pavement have stood the test of the hardest winters.

"Concrete, whether in a roadway or a building, not properly reinforced, will crack. There is no chance for argument about this point. Concrete with reinforcement which does not provide against all the possible stress is no better than plain concrete.

"A careful examination of the following excerpt from the Thomas system specifications will show to the engineer that the principle is based on sound and undisputed engineering principles:

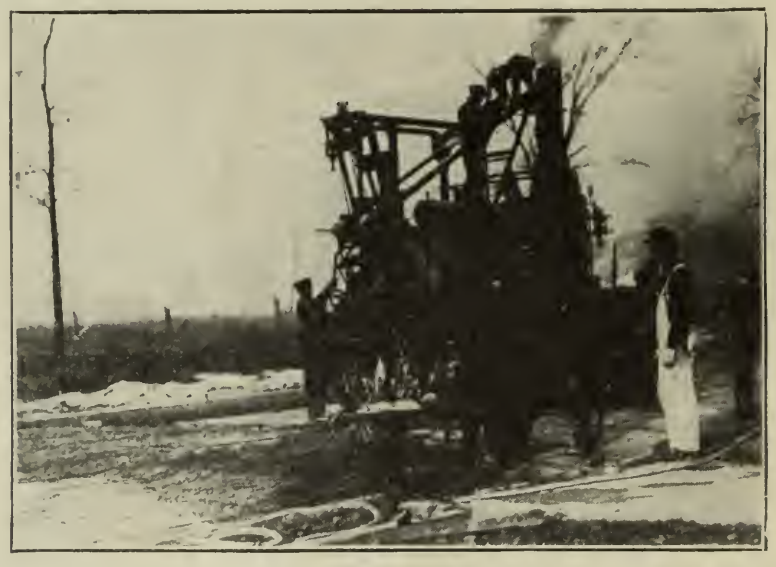
### Reinforcement.

The reinforcement in the mass of the concrete to be placed in the following manner:

The ⅜ round steel bars to be placed longitudinally and crossways 2 feet center to center and 1½ inches from the top surface of the finished concrete. The ¼-inch round steel bars to be placed longitudinally and crossways 4 feet, center to center and 5 inches from the top surface of the finished concrete, and both systems of bars to be well clamped together at their intersections. The two reinforcements to be properly supported in their respective places before any concrete is laid, and in proper lengths and widths so as to be embedded in concrete panels of 30 feet long by the whole width of the road. The top and bottom bars to be held firmly at intervals of 4 feet by an upright steel member, which will make a positively connected unit of the top and bottom bars thru the whole pavement.

### Expansion Joints.

Expansion joints ½ inch wide shall be placed at right angles to the curb line at intervals of 30 feet. Joints to have edge protected by means of a soft steel plate, 3-16x3 inches rolled to conform to the established crown of the pavement and said steel plates to be securely attached to the reinforcing bars of the pavement so that the concrete between the expansion joints works as a unit. Expansion joints without steel plates should also be placed along the side of the curb, ½ inch wide and the whole length of the paved street, the opening to extend to the bottom of the concrete base and space to be filled with asphalt filler of an approved brand. This filler is not to be placed until the wetting of the pavement after installation has been stopped.



*Thomas Steel Reinforcement in Place in Concrete Pavements. Note Reinforcing Bars in Foreground.*

*Port Huron All-Steel One-Way Spreading Dump Car.*

## Steel Spreading Dump Cars

One of the very prominent members of "The Port Huron line" of road-building machinery is the all-steel, one-way spreading dump car. This "car" contains no wood, its construction thruout is of metal; main frame is of channel steel and joints are hot riveted. The dumping devices or levers are low down and convenient for operation by the man while he is standing on the road. The wheels are large and very wide and they have roller bearings. The roller bearing not only reduces the draft, makes the car easy running, but is durable, and at small expense can be easily renewed. Wide and high wheels are necessary to avoid damaging the road traveled, and by the lapping of the front and rear wheels there is made a track 20 inches in width. The wide wheels and the lapping of tracks, together with the great loads, operate like a roller, in smoothing, compacting and putting the road bed in suitable condition. These cars are short turning, because of front wheels turning clear under, and because of extended hitches causing the cars to travel outward and trail nearly in the track of the roller or engine. The "goose-neck" section, or provision for front wheels turning clear under, includes special and extra strong castings, trussing, bracing and tieing by rods, plates and bars.

At many points on many jobs there is sufficient room for turning without uncoupling and this "car" has the advantage of saving time of uncoupling and recoupling.

A regular Port Huron roller with eight or less number of cars attached can be turned completely around in a space only about 30 feet in width, without uncoupling and without backing; any length train can be turned in only 15 feet 8 inches width by uncoupling and using a switch rope. These cars are furnished regularly with spreading dump, but can be furnished with either spreading or full dump, or both. If provisions for changing from spreading to full dump are required an extra door is needed and will be furnished at slight additional cost.

The spreading dump provides for spreading crushed stone, gravel, etc., over the roadway, 1 to 8 inches deep and 4 to 4½ feet wide, according to adjustment of doors, sizes of particles, evenness of ground, etc.

The full dump provides for opening fully and dumping at once in a heap, being designed for quick dumping and for releasing material that flows or dumps less rapidly than does crushed stone or gravel.

"The work of spreading crushed stone mechanically was first invented by us and we built cars for that purpose nearly 13 years ago," states Mr. D. C. Kinch, secretary of the Port Huron Engine and Thresher Company. "At that time we were also interested in building roads about our factories where this car was built for that particular work.

"The work accomplished was such a vast improvement on the old way of hand spreading that we at once saw a great future for the car and commenced building it and an Americanized roller for sale to the general public.

"We are now building a new boiler shop, one end of which will be devoted to the manufacture of these all-steel, hand-steering, stone-spreading and dump

cars and, with improved facilities for manufacturing, we would very much like to work up an increased demand, at least equal to our ability to produce the goods."

## Effects of Ornamental Lights

It pays to advertise. It pays not only the city doing the advertising, but it also benefits other cities. It invariably starts things. The street illumination methods of St. Paul, Minn., were widely heralded a few years, ago and Waterloo, Iowa, immediately sent a committee to investigate. They handed in a satisfactory report and immediately commenced a campaign for a similar white way in Waterloo, which was described in the January number.

"Our system of ornamental street lighting is the best advertisement and the greatest step in advancement ever taken by our city," says the mayor of Waterloo. "Now other cities near Waterloo and in distant parts of the country, say the same thing. In fact, all good things are gradually and continuously passed along."

"There is food for reflection in the thought of beautifying," states Mr. W. M. Hinckley, manager of the Waterloo Malleable Iron Works. "Ornamental lighting standards are an ornament by day and a source of light by night. They mean less crime, more business and cleaner streets."

## Sterling Paving Brick Cart

"On straight work from side piles our paving brick cart will show a saving of 50 per cent or more under the cost of carrying to the setters with the hand tongs," states Mr. Ward Lincoln of the Sterling Pattern Works, Sterling, Ill. "One man wheeling 36 bricks can deliver them to the setters as fast as six men with the hand tongs. Where the brick can be uniformly and accessibly piled, or in street intersections or alleys, the saving will be much greater, as the carts can be run directly to the brick pile, wherever located.

"The Sterling carts deposit the brick in piles close to the paving line, best side up and without disturbing the line, also with no possible liability of chipped or broken brick. One contractor, who has four carts, said they much more than paid for themselves in laying 180,000 block and another contracting firm who used the carts on straight work from side piles, says the saving in labor cost over the use of hand tongs is more than one-half, the setters were better served, the work was easier on the men, besides the saving in chipped and broken brick was very considerable.

"The carts are designed to carry 36 brick or 30 blocks separated into two piles each six brick wide and three high, with space between.

"For a wide or moderately wide street we would suggest the use of four carts, two for each side of the wagon or from

*Sterling Paving Brick Cart.*

each side pile, two men for loaders and one man for wheeler for each two carts, one cart being loaded while the wheeler is placing the other. For a narrow street probably three carts will answer, with a man for a wheeler for both sides. The carts are thoroly well made, having roller-bearing wheels 30 inches in diameter, with 2½-inch tire; weight 200 pounds."

## Street Sanitation in New Orleans

*By Geo. S. Smith, Deputy Commissioner, Dept. of Public Works, New Orleans, La.*

Owing to the rapid growth of New Orleans during the past year there is a greater demand for street cleaning, street grading, ditches, new bridges, culverts, footlaps, good streets and better drainage.

The tracer system and clock system are used successfully, while the work of looking after the condition of the streets is likewise facilitated by the reports regularly furnished by the New Orleans Railway and Light Company and the sewerage and water board of all cuts made by them, together with their location.

The complaint clerk keeps in touch with all such cuts thru the foremen of the wards in which they are made, and by constant reminders the department causes the above-named corporations to repair them.

Semi-annual inspections are made of all

*Etnyre horse-drawn street flusher in operation.*

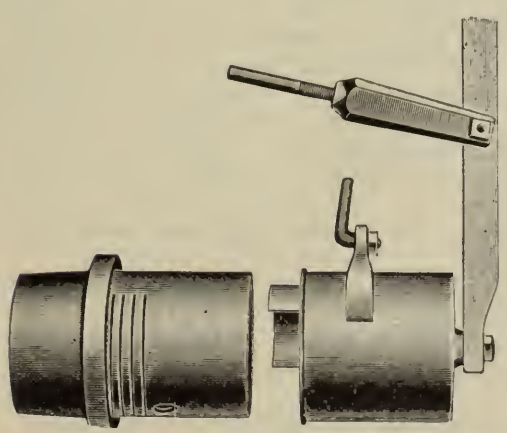
the garbage carts, street cleaning equipment and other paraphernalia employed in the general street cleaning work. New and improved apparatus is always looked into and the gradual enlargement of the service is apparent. At these inspections prizes are offered, which encourage neatness and cleanliness. This has a tendency to effect a complete and efficient service.

Three hundred and forty men are provided for in the department by budget, all in uniform and all variously assigned.

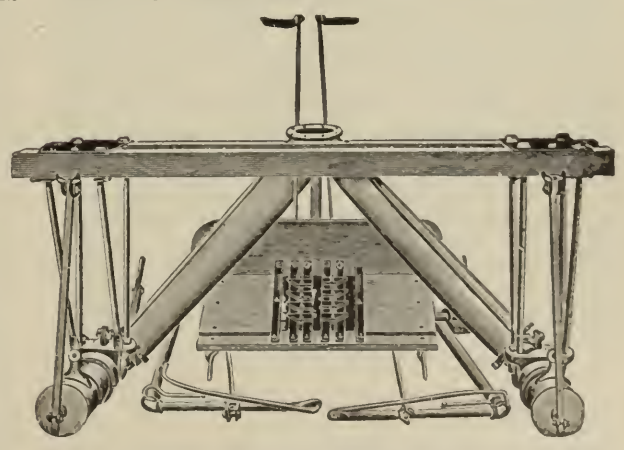
Large and commodious animal barns, stables for horses, warehouses for supplies, a broom factory for the manufacture of brooms, and feed barns are operated by this department and same are surrounded by stone-paved footwalks and driveways. There is good drainage in this section, and the entire place presents a fine appearance.

All brooms used on the street-sweeping machines are manufactured by the men of this department, in the broom factory. These brooms were formerly manufactured at a cost of $10 each. The actual cost now is $1.50 per broom. They are filled with split hickory, purchased in Huntsville, Ala. During the past year 200 brooms were manufactured by the men of this department, thus saving for the city $1,700.

There is a modern veterinary hospital located at our yards, where all sick and injured animals are treated, a wading pool for stock, constructed of brick and cement, and all appliances necessary for handling sick and injured animals can also be found here.



*Etnyre patent improved valve. Made of heavy brass and furnished with perforations if desired.*



*Complete vertical spray sprinkling attachments, readily attached to any style tank on any style of gear.*

This plant is equipped with a modern fire protection service, connected with the new water system, while a forty-gallon chemical engine is placed in commission at this barn.

The following stock and apparatus are now housed in the barn: 90 mules, 4 horses, 48 sets harness (double), 14 street-sweeping machines, 12 street-sprinkling machines, 9 flushing machines, 18 dump wagons, 2 egg wagons, 1 spraying wagon, 1 squeegee machine, 1 dump cart, 1 pick-up machine, 1 double-team float.

Our street sprinklers and flushers were made for us by E. D. Etnyre & Co., Oregon, Ill. We use our sprinklers on all kinds of paved streets as well as on all roadways, not paved, but which are subject to dust. Our flushers are used on all paved streets. These flushers clean, on an average, 42,000 square yards per day at an average cost of $0.0475 per 1,000 square yards. The flushers wash everything into the sewers and consequently we have no pickup carts, we use about 300 gallons of water per unit, altho everything depends on condition of streets.

As before stated, we own our teams and equipment thruout. Our drivers are paid at the rate of $2 per day.

The Etnyre patent sprinkling valve is exceedingly simple in construction and easy in operation. It is made without piston rods or packing boxes and does not leak. In the Etnyre patent the outer sleeve moves backward and forward on the outside of the water and shuts squarely against a rubber gasket, located in the shoulder of the valve, making an absolutely watertight joint. The gasket being stationary does not require frequent renewal. There are two valves, one for each side of the wagon, which work independently of each other, controlled by two foot levers at the driver's seat. As the operator releases the lever from the first ratchet in the footboard, which ratchet locks the valves shut, the pressure of water causes the outer sleeve to move backward, thus exposing the slots in the inner cylinders, the desired volume of water being discharged as more or less of the slots are exposed. Thus the lightest spray or the heaviest stream is instantly obtained at the will of the operator. The several ratchets secure the levers at any desired point, thus obviating the method of holding them with the feet. By releasing the lever, so as to expose the open end of cylinder, all trash is instantly removed. The outside sleeve is turned by the operator at the seat end to secure any desired width of spray.

## Street and Alley Cleaning

*By F. W. Solen, Acting Supt. of Streets, Chicago, Ill.*

In the treatment of a city's wastes, while it is always well to be as economical as possible, the matter of cost should be but a minor consideration. It should be the effort of all cities to dispose of the garbage in the most sanitary manner in order that the health of the citizens will be protected. After several years' experimenting in the disposition of Chicago's garbage, and investigation in other cities, it is my belief we have attained this end.

| | |
|---|---|
| Amount of garbage collected and delivered to the reduction plant in 1911, tons | 117,775 |
| Total cost for collection and disposition | $447,740.47 |
| Cost per ton | 3.80 |
| Cost per capita | .19.8 |

There was an increase of 18,275 tons in the amount of garbage delivered to the reduction plant over the year 1910.

In connection with city wastes the subject of miscellaneous refuse is an important one and I believe that such miscellaneous refuse can be treated by a process of incineration, and in order to equip this city with the proper methods of disposal of all wastes both the reduction and incineration methods should be used.

| | |
|---|---|
| Amount of ashes and miscellaneous refuse collected and disposed of by depositing in clay holes, etc., in 1911, cu. yds. | 1,388,200 |
| Total cost for collection and disposition | $825,437.67 |
| Cost per cubic yard | .61.6 |
| Cost per capita | .36.4 |

The work of street cleaning is as important as the disposition of the city wastes, as it has to do largely with the health and comfort of citizens, and during the past year every effort has been made to expend such moneys given us to keep our streets in as sightly and sanitary conditions as the moneys would allow. The most effective work in street cleaning in thickly settled districts can be accomplished by the "block system," together with street flushing machines, at night.

The work of street cleaning has been greatly handicapped by the lack of convenient places to dispose of street sweepings and it is the intention of the bureau to build additional loading stations in order that we may further utilize the street railways for the hauling of street dirt and miscellaneous wastes.

Under the work of "street and alley cleaning," the following moneys were expended in 1911, distributed as follows:

| | | |
|---|---|---|
| Number of square yards of pavement cleaned by hand, square yards | 2,441,347,873 | |
| Cost of hand cleaning | | $894,270.68 |
| Cost of hand cleaning, per 1,000 square yards | | .37.3 |
| Street dirt removed, loads | 201,045 | |
| Street dirt removed, cu. yds. | 735,334 | |
| Number of square yards of pavement cleaned by flushing machines, sq. yds. | 174,729,127 | |

| | |
|---|---|
| Cost of flushing | $30,365.68 |
| Cost of flushing, per 1,000 square yards | .17.3 |
| Cost of street cleaning, per capita | .41.6 |
| Cost of weed cutting | 3,344.00 |
| Material vouchers | 17,233.00 |
| Ditching | 11,159.24 |

Total expenditures, $956,372.00.

There is such a splendid organization of the forces that within 24 hours after an ordinary snowstorm practically all traces of the snow are removed from the streets in the "Loop District."

| | |
|---|---|
| Amount of snow removed, First ward, cubic yards | 111,177 |
| Cost of removal | $45,344.86 |
| Cost per cubic yard | .40.7 |

In the collection of garbage we use a specially designed tank wagon, made by the Bain Wagon Company of Kenosha, Wis. We have over 200 of these wagons in operation, each of which is of 4-cubic-yard capacity.

figured with. "Today a great many of the leading farmers of the country own automobiles," he said, "and it is going to be necessary in a few years at any rate to have the roads in such shape that they can be used by automobiles at all times. In fact, the automobile is fast becoming the farmer's carriage and is not simply a pleasure vehicle either. The farmer who owns an automobile has bought it and paid for it and he hasn't had to spend his last cent or mortgage his farm to get it either. So the farmer who owns an automobile is reasonably certain to pay cash for his goods, to pay his just share for county and township road improvements. Then, too, when he comes to town he doesn't come alone. He brings neighbors, who do not own automobiles, but who happen to have business in town. When they get to town nearly all of them make some purchases and thus the automobile trade from the country is becoming quite a factor in our

*Russell Grader on road work.*

## Graders for Road Purposes

Someone has said that the country county seat needs good roads more than it needs factories. Perhaps a better way to state the proposition would be to say that it needs them both. It certainly needs good roads.

A prominent merchant of Fargo, N. D., in speaking on this topic said, that in conversation with a merchant from one of the neighboring towns recently, he asked him how business was progressing and the answer was "fine; we haven't had as good business for years as we have had during the past week or so."

"I asked him the occasion for this increase in business," said the Fargo man, "and his answer was, 'The roads have been so bad that our people couldn't get to Fargo and so they've been trading at home.'"

Continuing the merchant declared that the large number of automobiles owned by farmers had become an element to be business and that's why the business men of different towns are interested in the good roads movement. In a little trip I took the other day towards Grundy Center, I passed seven automobiles owned by farmers and each one loaded with farmers, coming to town on business. This is only one example of what happened in one day on one of the roads leading to the city, and it wasn't a first-class road either, altho preparations are under way to make it the finest highway in the state, the construction of which will start early in the spring."

The accompanying illustration shows a type of elevating road grader very suitable for just such work as outlined in the foregoing. This grader is made by the Russell Grader Manufacturing Company, Minneapolis, Minn., and in three sizes.

The "Township" or "Size A" is the size very appropriate for building roads. The carrier is 18 feet in length and may be reduced to 15 feet by removing a 3-foot section.

"Contractors Standard" or "Size B" is a much stronger machine thruout, and is especially suited to the contractor's needs. The carrier is 21 feet in length and may be reduced to 15 or 18 feet by removable sections. It is also equipped for wagon loading and has roller guides at outer end of carrier to prevent catching on wagon box.

"Contractors Special" or "Size C" is still larger and stronger than the Standard, and is designed for special work where a very long carrier is required. The carrier is made sectional and can be adjusted to various lengths, so as to convey the dirt from 18 feet to over 28 feet.

## Detroit Has Earned Its Asphalt Plant

With the close of the season of 1913 the Municipal Asphalt Paving plant of the city of Detroit will stand upon the records of that city as free of cost. It has just finished its ninth year of service and each year 10 per cent of its cost has been charged off to the cost of the paving operations. The plant is yet in very good condition and will serve for some years to come. The success of the city of Detroit in operating its own paving plant has been notable; this is due to the fact that in that city this branch of the service is free from political disturbances and the city has been enabled to train and retain a very efficient and capable organization under the control of Mr. Haarer, commissioner of public works, and Mr. Clarence Proctor, the superintendent and asphalt expert who came originally to Detroit nine years ago from the laboratory of Mr. Dow.

The city of Detroit is notable for the excellent condition of its asphalt streets. Repairs and also new work have been made at the lowest possible cost to the taxpayers and of the very best quality. In order to still further expand its usefulness this department of the public service of that city has recently given to Hetherington & Berner, the builders of the original plant, a contract for still another plant, one having a capacity of 3,000 square yards of asphalt pavement per day and one that will embody all of the later improvements in plant building.

The Hetherington & Berner Company have built municipal paving plants in many cities in various parts of the country and all of them have done well; at the present writing that company is completing the installation of a very large plant for the city of Chicago and also a plant similar to the Indianapolis plant for the city of Camden, N. J. This company has also recently built and shipped out one of its Model 1912, two-car railway plants, to Canada and a one-car plant to Jackson, Mich., the latter being operated by the Cleveland Trinidad Paving Company of Cleveland.

## Trade Publications

"A Fire Department in Your Own Building," is the title of a new booklet by the H. W. Johns-Manville Company, describing the liquid, non-freezing, and dry powder classes of hand chemical fire extinguishers manufactured by that company.

The Chain Belt Company, Milwaukee, Wis., issues a periodical circular of 8 pages; that for January showing a reinforced concrete stairway and pavilion in reinforced concrete with no supports except at the lower end, which is used to gain a general view of the Exposition of Trade, Industry and Agriculture, at Koslin, Pomerania. It is 36 feet high.

## Trade Notes

Dow and Smith, well-known chemical engineers and paving experts, have removed their headquarters from 24 East Twenty-first street to the Fifth National Bank building, 131 East Twenty-third street, New York city. Their new quarters are considerably larger than the old and are better equipped for handling the extensive work of the firm.

At a recent meeting of the board of directors of the Union Clay Products Company, New York, Edwin F. Kellogg was elected president and W. W. Dixon, secretary and treasurer. Mr. Dixon has been the leading spirit in the company since its organization. His work, heretofore, has been particularly in the sales department, but under the new management he will be in complete charge of all departments.

The Case 110-h. p. steam engine actually won the gold medal for highest number of points in its class and sweepstakes honors for the highest number of points in any class, at the Winnipeg motor contest. A clerical error made the first announcement incorrect. This engine and many others are made by the J. I. Case Threshing Machine Company, Racine, Wis.

After much deliberation and discussion of various materials the directors of the port of Boston, Mass., on January 30, ordered 63,000 square yards of bitulithic pavement for the first floor of the big Commonwealth pier, 4, 094 square yards of wooden block for the carriage concourse on the second floor and 20,900 square yards of granolithic for the part of the second floor to be used for foot passengers.

# MUNICIPAL ENGINEERING

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*Laying pavement foundations, Jas. A. Sackley Co., contractors.*

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Photo by Moffett, Chicago.

WILLIAM W. MARR

(See Men Prominent in Municipal Affairs, page 204.)

WITHIN the last two or three years the city of Pittsburgh, Pa., has distinguished itself by the character and beauty of the designs made for the numerous bridges over streams, railroads, boulevards and streets which are made necessary by the exceedingly irregular topography of the city plans and the necessity of connecting the upper levels of the city without descending to the lower levels. Indeed, as may be seen from the photographs, descent on the one side and ascent on the other would be more difficult and in the long run more expensive than the bridges which are used.

### How the Funds Are Raised

The funds required for building the new bridges and rebuilding some of the old ones were raised by votes of the people in 1908 and 1910.

Prior to 1908 the sums paid for bridge maintenance were extremely small, not 1 per cent of the valuation of the property.

There are in the city some 78 bridges of all kinds with spans of 20 to 800 feet, valued at $5,000,000.

Most of the old bridges were of steel, naturally, since Pittsburgh is the center of the steel industry. But, just as naturally, the smoky atmosphere, laden with the gases generated in the manufacture of this steel, attacks the steel and destroys it more rapidly than elsewhere, unless under exceptionally bad conditions.

### The Beginning of the Use of Concrete

In 1907 it was decided to use concrete to protect the steel in the bridges and several bridges were encased in concrete in 1908, particularly the columns and struts. Among the bridges so treated were Millvale avenue and Twenty-eighth street bridges over the Pennsylvania railroad. Cement sidewalks, acting in part as protection to the steel, were laid on South Tenth and Twenty-second streets, Negley and Aiken avenue and several smaller bridges.

In 1909 three small wooden bridges over Saw Mill Run were replaced with reinforced concrete girders of 15.5 to 35 feet span and 12 to 20-foot roadways, supported on masonry abutments. Graham and Blaine street foot bridges over railroad tracks were also constructed of reinforced concrete.

The popular votes were for bond issues to pay for projects which included several large bridges and it was decided to build six of these of reinforced concrete. Their size and prominence really demanded artistic treatment and the designs show that graceful lines and pleas-

PLATE I. *Meadow Street Bridge over Negley Run, Looking North.*

ing composition have been duly considered.

### Meadow Street Bridge

The first of these bridges was the Meadow street bridge over Negley Run, shown in Plate I. This span is 209 feet long, with rise of 46.14 feet, a proportion of 1 to 4.53. The total length of the bridge is 454 feet and its width is 50 feet; there being two 10-foot sidewalks, which overhang the outside ribs of the arches and are supported on cantilever brackets.

The main span is a three-centered arch approaching a parabola, with the line of pressure close to the axis of the arch ribs at all points.

There are three of these arch ribs, having depth of 5 feet at the crown and 6 feet 2 inches at the springing line. The two outside ribs are 3 feet 9 inches wide throughout and the center rib 5 feet. These ribs are bound together by the horizontal struts seen in the photograph, causing them to act together against all lateral stresses.

The main piers are of cellular construction. The secondary arch system with its column supports and lateral bracing as their tops is clearly shown in the photograph.

The reinforcement is of monolith bars, made of medium open-hearth steel.

The bridge cost $72,000.

### Atherton Avenue Bridge

Atherton avenue is one block from Center avenue and parallel with it. To relieve the congestion on the latter street the former was widened and improved. This required two new bridges. One of these, over the Pittsburgh Junction railroad is shown in Plate II. Contract and specifications for this bridge were prepared in 1911 and it is now finished at a cost of $95,000.

The main span is 168.5 feet, with a rise of 32.5 feet. The total length of the bridge is 418 feet, and its width is 60 feet with two 12-foot sidewalks, which are flush with the outer faces of the arch ribs. The main span has two arch ribs set 37.5 feet apart between centers and each one 14 feet wide, 3.5 feet deep at the crown and 7 feet deep at the springing line. The span on the left in the photograph is 60 feet and that on the right (east) is 45 feet with the same two arch ribs of the same width.

The piers are solid, to take the thrust of the short arches, which, as shown, spring from the abutments a considerable distance, 22.8 feet, above the springing line of the main arch.

Structural steel was used as reinforcement in the main arch ribs, and Kahn and Diamond bars were used elsewhere. All steel is open hearth. The concrete in arch ribs was of broken stone aggregate in 1:2:4 proportions; that in the foundations was of 1:2:5:5 proportions and in columns, floor system and all other parts of 1:2:4 proportions with gravel aggregate. The bridge contains 7,960 cubic yards of concrete and 626,800 pounds of steel reinforcement.

The valley which this bridge crosses is of less depth and width than that crossed by the Meadow street bridge and the proportion of rise to span is less, being about 1:5. This makes a material difference in the character of the designs and in the appearance of the bridges.

### Another Atherton Avenue Bridge

Plate III shows another bridge on the widened and improved Atherton avenue, which crosses the Pennsylvania railroad. This bridge was begun and finished in 1912, except railing and pavement. The valley which it crosses is wide and comparatively shallow and the street crosses the railroad at an angle of 62 degrees 45 minutes, so that skew arches are required. There are three 90-foot arches, the total length of the bridge and approaches is 380 feet, the width 60 feet with two 12-foot sidewalks, flush with the arch faces. The arch rings are 2.5 feet deep at the crown and 9 feet vertical depth at the springing line.

Steel centering was used for the construction of the arches and spans the tracks under the arch as shown in Plate III. One-half of the arch rings for the width of the bridge were first constructed for the full length of the three spans. The false work was then lowered onto rollers and shifted into position for building the other half of the arch rings.

A gravity system, as shown in the photograph, was used in placing the concrete, the restricted spaces at the ends of the bridge preventing the use of cableways as in the other bridges mentioned.

The bridge is complete as shown, except railing and pavement. There are 8,700 cubic yards of concrete and 519,000 pounds of steel reinforcement in its and the total cost will be about $95,000. Diamon bars were used and in the arch rings they were held in place by structural steel cross struts, to which they were attached.

### Surface Finish of Concrete

Two kinds of surface finish can be distinguished in some of the photographs. For the plain finish the forms were removed in 24 to 48 hours after the concrete was placed and the surfaces were immediately rubbed with suitable appliances to remove all form marks and other surface irregularities so as to leave them all plane and true and of a uniform sandy finish over the whole surface so worked. On most bridges a smooth coat of Portland cement grout, 1 cement to 2 sand, was applied with a brush, but that was omitted in this case. For the ornamental surfaces the specifications required in this bridge that not less than 30 days after placing the concrete the surface should be gone over with a bush hammer having not more than eight points per square inch of the hammer surface. The concrete was carefully spaded while it was being placed so as to remove the larger stones from the surface.

The ornamental surfaces on the bridge, shown in Plate II, were made by placing a mortar coating 1½ inches thick next the forms, which was thoroughly bonded to the concrete by tamping as it was placed. The bush hammer, if pneumatic, was required to have not more than one point per square inch of hammer face, or not more than four if a hand tool.

The intrados of the arch spans was rubbed off to a smooth, even surface, free

PLATE II. *Atherton Avenue Bridge over Pittsburg Junction Railroad, Looking North.*

from all fins, rough spots or blemishes.

The filling for roadway and sidewalks is blast furnace slag, granulated, and retained by spandrel walls. The sidewalks and the concrete base of the asphalt pavement will be laid on this slag filling.

### Waterproofing

The extrados of the arch spans were waterproofed by rubbing off all rough places, scum or laitance so as to leave a uniform, sandy surface, smooth and true to curvature, which was given three finish coats of a mixture of two parts Portland cement and one part sharp sand passing a 12-mesh screen. Each coat was thoroly brushed into the entire surface so as to form a uniform unbroken crating which was allowed to set hard before applying the next. The first coat was rubbed in thoroly with a wooden float and the last coat was smoothed down with a trowel.

### Larimer Avenue Bridge

The Larimer avenue bridge over Washington boulevard, finished in the summer of 1912, is the largest of these reinforced concrete arches yet built. The main arch has a span of 300 feet 4⅞ inches. The bridge is 670 feet long, 50 feet wide with two 10-foot sidewalks, and is 110 feet above the ground. There are two arch ribs, 30 feet apart, as seen in Plate IV, each 8 feet wide, 6.5 feet deep at the crown and 11 feet at the springing line.

The concrete was reinforced with Mueser Diamond bars except the arch ribs, where structural shapes were used. Gravel aggregate was used below the ground level and crushed limestone above. Expansion joints for the roadway were located at the abutements, the main piers and the third columns from the main piers.

The bridge contains 9,471 cubic yards of concrete and cost $170,000.

In the designs of the bridges just described much attention has been paid to their artistic appearance, more than is usual in city work. Economy in construction in order to keep within appropriations or debt or taxation limits often prevents proper attention to the artistic features, and, while none of the bridges shown are monumental in their style of architecture they are distinctly pleasing and are sufficiently different in design to prevent the criticism that they conform only with the demands of utility, which would make them of a dead sameness of design.

### Design for Murray Avenue Bridge

Plate V shows a revised design for a bridge on Murray avenue over William Pitt boulevard, the history of which illustrates the difficulty of fitting together a fixed appropriation and a desire for a monumental structure. The new Municipal Art Commission now passes upon designs for all bridges costing over $20,000. They desired such a monumental and artistic structure and plans were prepared for one, but it could not be built for the appropriation and more money was not available. It provided for two 117-foot spans, ring arches, spandrel walls and filled roadway with the attendant difficulties in maintaining the roadway, and would require 9,400 cubic yards of concrete and 834,000 pounds of steel reinforcement.

The design shown in Plate V is for a reinforced concrete arch bridge 375 feet long, 60 feet wide, with two 10-foot sidewalks on cantilever brackets, the main span being 210 feet with rise of 35 feet, depth of rib at crown 5.5 feet and at springing line 11 feet, there being two arch ribs each 10 feet wide and 33 feet apart on centers. It is quite similar in design to the Meadow street bridge, Plate I, requiring 4,500 cubic yards of concrete and 400,000 pounds of steel reinforcement. The estimated cost is $40,000 less than that of the first design and it has no spandrel filling to trouble the roadway and its drainage.

### Design for Haights Run Bridge

The appropriation for Haights Run bridge, shown in the heading to this article is $150,000. As it will have but a single span of 195 feet and a rise of 25 feet, there is more opportunity to give special attention to the architectural features. This bridge is on Butler street at the intersection of the boulevard, park drive and Nineteenth street bridge to Sharpsburg over the Allegheny river. It

is an important step toward building a suitable entrance to Highland park from Butler street. A design is, therefore, demanded which will be in harmony with the beauty spot by which it will be surrounded, and at the same time take care of the business traffic. The bridge will have a width of 60 feet, divided into a 36-foot roadway and two 12-foot sidewalks. Two arch ribs will support the roadway.

PLATE III. *Atherton Avenue Bridge over Pennsylvania Railroad, Looking Northwest.*

At the left (west) end will be located, as shown in the photograph of the plan, two large ornamental pylons of concrete and stone, and the railing will be of particularly ornamental design; this conforming with the comprehensive plan for an adequate park entrance.

These last two bridges will be constructed in 1913.

These bridges are designed and constructed by the Department of Public Works, of the city of Pittsburgh, thru its Bureau of Construction, of which N. S. Sprague, M. Am. Soc. C. E., is superintendent, to whom we are indebted for the photographs and information included in this article.

### Engineering and Architectural Principles Followed

In a recent paper Mr. Sprague has the following to say regarding the principles followed in the designs:

"In making the plans for the large concrete bridges the principal dimensions and general type of bridge were determined largely by the profile of the ground and required certain forms of construction which could not be changed, however desirable it might be in order to give better lines to the structure. The architecture on some of these bridges, broadly speaking, was divided into two classes: First, the best architectural treatment possible to such parts of the bridge as were fixed by scientific principles of design or local conditions which could not be changed, and second, those embellishments which add nothing to the strength, serve no useful purpose, but which add greatly to the beauty and grace of the structure. The first class adds little additional cost, but the second class will in general greatly increase the cost of the structure. Having satisfied the utilitarian requirements, many modifications are frequently required to produce an artistic looking structure. Theoretically the best manner of procedure is the adjustment of the type of bridge to the site under consideration. Graceful and pleasing lines can be adopted in all cases, even where the necessity for the strictest economy prevails. Where funds are available and where conditions make it desirable, strict conformance to architectural features and precepts are most commendable."

PLATE IV. *Larimer Avenue Bridge over Washington Boulevard, Looking North.*

### Good Workmanship Demanded

Mr. Sprague emphasizes the necessity of thoroly good workmanship in construction in the following words:

"However carefully and accurately designed a concrete bridge may be, the work of the designer may be set at naught by delegating the construction to incompetent, inexperienced and unskilled contractors. A large bridge is an imposing and monumental structure, generally used and seen daily by thousands of people, which emphasizes the importance and makes necessary for the engineer to require the same degree of excellence of workmanship and skillful management as the architect demands in the execution of his plans for some magnificient building. The problem of the engineer in this respect is much more difficult of attainment than for the architect, since on concrete bridge construction most of the work is performed by unskilled labor and with the use of more difficult materials. A large concrete bridge is composed of a number of large monolithic sections, which must of necessity be built in several parts at different times and under varying conditions, all of which demand the utmost attention and watchfulness to the adequate bracing of the forms and their true and correct alignment. The bulging of a form or the unnoticed escape of grout from the concrete are defects which may not impair the strength of ordinary construction and which are easily remedied in most forms of concrete work, but in bridge work these accidents are liable to result in ruining the appearance of the whole bridge."

### Experiments on Surface Finishes for Concrete

A very important and troublesome detail in the finish of concrete structures in accordance with the demands of art is the treatment of the surface. Mr. Sprague has made some pronounced advances toward the solution of the problem of securing pleasing surfaces for concrete which he discusses and describes as follows:

"Closely related to the importance of good workmanship on concrete bridges is the question of concrete surface finish. This may seem like a relatively unimportant matter to some engineers and a detail which is unworthy of their serious consideration; this is undoubtedly true for some structures, but the writer is convinced that if the general use of concrete for bridges, buildings, towers, etc., is to continue, its future use for these structures will depend in no small measure upon the ability of the engineer to produce effects in the surface finish of the concrete which will compare favorably and furnish an equally good contrast with other kinds of building materials. There is here open a large and profitable field for investigation and experiments along this line. The smooth concrete surface with its uniform color is lacking in character and individuality, which makes it desirable to roughen the surfaces and expose the stone in the concrete or else incorporate into the mass materials other than those ordinarily used in its composition. I am of the opinion that the ultimate solution of this most important question will be found in this manner, rather than by the applica-

tion of external treatments. In some cases the writer has been successful in obtaining good results by bush-hammering the concrete with a hammer having about 11 points to the square inch. This method of finishing the concrete surface requires the use of broken stone aggregate instead of gravel and considerable skill on the part of the workmen to obtain a uniform finish and prevent chipping the corners.

"With a view of improving and of producing a greater contrast and a more pleasing appearance in concrete surfaces upon different parts of the bridges, we made some experiments with blocks of concrete, using broken red bricks, brick dust and Ligonier limestone screenings for the aggregate instead of gravel and broken stone. Three blocks of concrete were made using different aggregates.

"Sample No. 1 was composed of 1 part of Portland cement, 2 parts brick screenings, varying from dust to ¼-inch, and 4 parts of broken brick graded from ¼-inch to 1½-inch.

"Sample No. 2 was composed of 1 part Portland cement, 2 parts limestone screenings, graded from dust to ¼-inch, and 4 parts of broken brick, graded from ¼-inch to 1½-inch.

"Sample No. 3 was composed of 1 part Portland cement, 2 parts Allegheny River sand and 4 parts broken brick, varying in size from ¼-inch to 2½-inch. Twenty-four hours after the pouring of the sample blocks of concrete the forms were removed and they were allowed to season for a period of thirty days. The surface of the blocks were then bush-hammered with pneumatic hammers having about 11 points to the square inch. The outside skin of the concrete was removed to expose the brick used in its mixture.

"Sample No. 1 presented a uniformly dark red brick color.

"Sample No. 2 presented a mottled surface of gray and red.

"Sample No. 3 resulted in the usual gray color of concrete, mottled with red, which gave little contrast and was unsatisfactory in appearance.

### A Successful Surface Finish for Concrete

"The result of these experiments were so satisfactory that it was decided to incorporate concrete, made in this manner, into certain parts of the Hoeveler street bridge. This bride, which is now practically finished except the paving, is located in the East Liberty section of the city. It is a small bridge, 154 feet in length, with a single arch ring having a span of 60 feet, with spandrel walls and a filled roadway. The specifications required the contractor to use concrete of various aggregates for the different parts of the bridge, as follows:

"The concrete for the arch abutments below the ground line and for the footings of the abutment side walls shall be composed of 1 part of Portland cement, 2½ parts sand and 5 parts gravel.

"The concrete for the arch ring above the ground line shall be composed of 1 part Portland cement, 2 parts sand and 4 parts broken stone.

"The concrete in the abutment side walls above footings, except posts at end of walls and the ornamental top and inside face of parapet walls, also the spandrel walls over arch, except ornamental top and inside face of parapet walls and seal over crown of arch shall be composed of 1 part Portland cement, 2 parts brick dust and 4 parts broken brick.

"The concrete for the posts at ends of abutment sidewalks and the ornamental top and inside face of parapet walls over abutment sidewalls and spandrel walls, excepting seal at crown of arch shall be composed of 1 part Portland cement, 2 parts Ligonier screenings and 4 parts broken brick.

"The concrete for the seals over the crown of the arch shall be composed of 1 part Portland cement and 2 parts Ligonier screenings.

"The following specification was used for the broken brick, brick dust, broken stone and Ligonier screenings:

" 'Broken Brick—The broken brick used as aggregate shall be crushed, hard burned, dark red brick of uniform color. The crushed brick shall be of graded sizes, the largest of which must pass thru a one and one-half (1½) inch mesh screen and the smallest must be retained upon a one-fourth (¼) inch mesh screen.

" 'Brick Dust—The brick dust shall be

made from the same quality of brick as broken brick and shall pass thru a one-quarter (¼) inch mesh screen. The use of soft or yellow brick for either broken brick or brick dust will not be permitted.

" 'Broken Stone—The broken stone used as aggregate in concrete shall be fragments of hard, durable stone broken so as to pass through a screen having one (1-inch) inch mesh and be retained on a screen having one-quarter (¼-inch) inch mesh and be evenly graded from fine to coarse.

" 'Ligonier Screenings—The Ligonier screenings used in the ornamental scrolls and wearing surface of sidewalks shall pass thru a screen having two (2) meshes per lineal inch and at least seventy (70) per cent be retained on a screen having ten (10) meshes per lineal inch.'

"As to the result of this experiment opinions seem to differ. From an artistic point of view it has been pronounced a great success, and one eminent railroad engineer who viewed the work disapproved of the whole idea. Personally, I think we have achieved something which will at least lay the foundation for future designs and which has overcome in some degree the objection raised by many to the general use of concrete for building purposes on account of the difficulty in obtaining a suitable contrast in its texture."

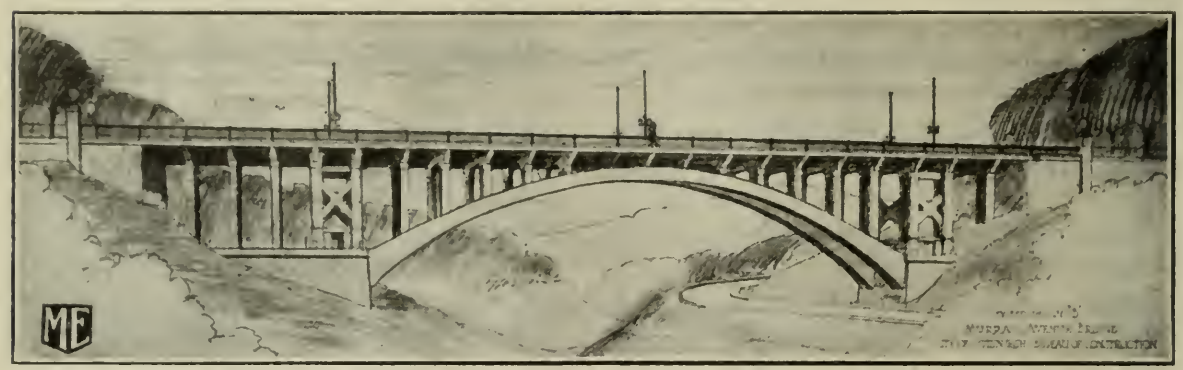


PLATE V. *Design for Murray Avenue Bridge over William Pitt Boulevard.*

# MACOMB WATERWORKS A MODEL FOR SMALLER CITIES.

The city of Macomb, Ill., has now a waterworks system, equal to any in the states, completed at a cost of about $50,000, including a 112,000-gallon-capacity standpipe, just brought into service. Water is secured from Lamoine River, commonly known as Crooked Creek, a distance of a mile from the business district. The standpipe is in close proximity to the pump house, located near the dam, and with the modern machinery a very satisfactory pressure is apparent at all times, 85 pounds being maintained, which is enough to throw water 85 feet high from a fire department hose. This is amply sufficient, as the highest structures are only 65 feet in height. The plant's capacity is a million gallons daily, but only 300,000 is being used in the city. J. M. M. Keefer, retiring mayor, estimates that the system will easily clear the city $5,000 yearly. The system which this displaced has cost the city $3,000 yearly. By the old method, with improper machinery, the city was supplied with water from deep wells. The water was not considered especially healthy either. City Chemist Drake keeps in close touch with the engineer at the waterworks and advises on the mixing of the filtering compounds at different times, as for instance when the creek is muddy and also when water is colored by leaves, etc. This insures good, wholesome water for the city at all times.

# FAILURE OF NASHVILLE RESERVOIR

*An example which demonstrated that a slight additional initial cost for proper water-proofing might have prevented a costly failure.*

THE water works reservoir at Nashville, Tenn., is an approximate ellipse in plan, its walls being drawn as circles with 356 and 187 feet radii, so that it is 603 feet long and 463 feet wide inside. It is divided into two equal basins by a straight wall across the short dimension. It was built in 1888 and 1889. The reservoir is located on top of a limestone hill in the southeastern part of the city, 277 feet above the Cumberland river and from 100 to 200 feet above the various levels in the city. The capacity of each half, with water 31 feet deep, is about 25,000,000 gallons.

The outer walls were built of stone taken off the top of the hill above the present bottom of the reservoir and are of rough ashlar laid with Louisville cement mortar of 1 cement to 2 sand. Some concrete is used in the central portion of the wall, partly for economy and partly to reduce leakage thru the wall. This concrete is irregular. The wall and concrete seem to be of good average workmanship and materials and are strong enough for their regular duties. The outer wall is 33 feet 9 inches high and 22 feet 9 inches thick at the bottom and 8 feet at the top, the curves of the vertical section being circular arcs of 74.36 feet radius on the outside and 64.6 feet on the inside. The division wall is 8 feet thick at the top and both sides are circular arcs in vertical sections of 74.36 feet radius.

The material excavated from the top of the hill which was not used in building the walls was dumped around the outside, forming a driveway entirely around the reservoir. This fill is supported by the outcropping edges of the layers of stone forming the hill, the outer wall of the reservoir being located quite near the outside edge of the layers outcropping just below the level to which the hill was taken off to form the bottom of the reservoir. The water in the reservoir is all above the finished ground surface.

It develops now that the layers of rock are not horizontal, but dip quite uniformly some 3 to 4 degrees from the horizontal, toward the northwest. except that at the southeast side where the break first occurred there is, according to the report of A. H. Purdue, the state geologist, a small fold which produces a dip of 8 degrees in the southeasterly direction, and away from the center of the reservoir. The wall on this side stood on this area of reverse dip.

The rock layers underneath the reservoir, as shown by the breaks made by the accident which occurred near midnight, November 4, 1912, are alternately limestone and shale, of varying thickness. The shale weathers to clay and water leaching thru it would have the same effect.

Such being the conditions, the reasons for the accident referred to may be readily inferred.

The walls of the reservoir have always leaked to a greater or less extent. The western half of the reservoir, now serving the city, now shows some leakage thru its wall and the surface of the ground near the foot of the wall was quite wet when it was inspected the last of December, partly, perhaps, because of recent rains, altho farther out the ground was nearly dry. It is probable that similar, and perhaps greater, leakage took place thru the bottom of the reservoir, which was not uniformly well covered with concrete and was not specially treated to prevent leak-

age. After some 24 years of use this leakage and the seepage of the water thru the shale layers has turned some of them into clay, and, evidently, an 8-degree dip was too great for the stability of the layers under the pressure of the weight of the wall and the water behind it, and a slip took place which carried the foot of the wall out and broke it in at least three places within a length of about 160 feet.

Plate I is taken to show the outcropping layers of rock exposed by the flood of water running down the hill from the broken reservoir. The indications are that the dip of these layers is down into the hill and to the right, which is that of the layers generally, and that the fold with dip in in the opposite direction, described by Mr. Purdue, was located under the part of the wall that failed. In the background of Plate I are seen the undisturbed wall of the reservoir on the right and one of the broken sections on the left. The mass of broken rock and soil washed away by the flood from the break is indicated by the pile remaining on the extreme left.

Plate II shows the end of the broken section seen in Plate I and the next broken section to the left. The quality of the masonry is indicated, also the slipping out of the bottom of the wall, which tipped the top back toward the reservoir. The third section, still further to the left, which is smaller and is overturned, would show this still more clearly. The bottom of the section in the foreground of Plate II has some four feet of the foundation rock attached to it and the outer toe of this mass has been raised several feet above its original position in the process of sliding out and tipping back. The clay and shale layers were clearly seen on inspection and the weak place seemed to be about four feet below the bottom of the wall in a layer some three or four feet thick which was made up of thin alternate layers of limestone and shale converted largely into clay, so thin that the mass was easily broken up when the softening of the clay lubricated the areas enough to overcome the resistance of the friction of stone upon shale and thus permitted movement under the pressure of the wall above and the water behind it.

The opposite (north) wall of the east basin of the reservoir can be seen on the left of Plate II and the surface of the mud on the bottom is also visible.

Plate III is from a photograph taken from about the same location as Plate I, but in the opposite direction, and shows the force of the flood in carrying rock down the hill and moving houses in its course. The street car tracks in the foreground had been cleared of several feet of rock before this photograph was taken.

Plate I was taken looking nearly west and in the track of one of three streams which flowed from the reservoir. Plate IV was taken looking northwest in another of the streams and shows the force of the water in carrying vast masses of rock for long distances down the hillside. The break in the reservoir is dimly seen in the background, the hole left by the overturning of the third broken section showing clearly and the sections seen in Plate II, less clearly.

There were apparently two sources of weakness in the reservoir; lack of sufficient depth of foundation and at the same time distance to the edge of the rock formation; and insufficient provision for prevention of leakage. Rudolph Hering, who was called in consultation, considers that the former can be taken care of at the point of the break and need not be feared elsewhere, provided the inner surface of the reservoir is waterproofed so that no more water can leak thru the shale layers below, and this looks very reasonable under the present conditions. It must not be forgotten, however, that the general dip of the rock is down in the direction of the unbroken half of the reservoir and that the general tendency to slip is in that direction, which is nearly opposite that in which the slip actually took place. The degree of dip may be sufficiently less so that the friction will not be overcome, but the observed increase and reversal in dip makes one wonder whether there may not be some other spot whose weakness may develop later if there is not complete success in

FAILURE *of Nashville Reservoir.*

*Looking up hill to broken wall. Note wash by flood and the edges of rock strata.*

*Looking down hill from same spot. Note stone carried down and wrecked houses.*

*Two broken segments of dam.*

*Looking up hill thru another flood channel. Note destruction and size of stones washed down. Breach in reservoir wall in background.*

waterproofing the reservoir or if the foundation is not made more secure by buried retaining walls outside the present foundations or otherwise.

If the reservoir had been waterproofed when it was constructed it is probable that the weakness which caused the accident would not have developed.

We are indebted to the Tennessee State Geological Survey for the photographs showing the break and some of its consequences.

A break in one corner of the lining of the new reservoir of the Johnson City, Tenn., water supply, which was filled with water on January 8, and failed January 10, is probably another example of the desirability of thoro waterproofing of reservoir linings. This small reservoir, 4,000,000 gallons capacity was located on a limestone hill which had caverns of greater or less size in it. One corner of the reservoir ran out over an earth foundation. The sides and bottom were lined with 8 inches of concrete reinforced with ⅝-inch twisted rods, 18 inches between centers, both ways. The lining was not waterproofed but was intended to make the reservoir water tight, being 1:2:4 broken stone concrete from limestone on the ground. The joint where the concrete of the bottom joined the lining of the side slope was not good and it seems that the water leaking thru carried the earth of the foundation away thru crevices or small caverns until the weight of the water was greater than the unsupported concrete would bear and an irregular hole about 8 feet wide by 6 feet high was broken in the lining of one side at the junction of two sides and bottom. After the water had run out it was found that the earth had been washed away 35 feet straight down and about 30 feet under the reservoir floor. The water did not run out over the surface immediately, but came out of the hill some 35 feet below the level of the bottom of the reservoir and nearly 200 feet away. Again a watertight lining would probably have prevented accident, altho it is evident that there were other possibilities of failure.

# BALTIMORE THE CITY OF PARKS

*By Stuart Stevens Scott.*

*Thomas Swann, Mayor of Baltimore in 1860, conceived and put into practice a plan of taxing the Street Railway Company for the maintenance of public parks. As a result of this plan the net cost to Baltimore for its 2,266 acres of parks has been less than $10,000.*

ALTHO Baltimore is better known as the "Monumental City," an equally appropriate name would be "The City of Public Parks," for there are, perhaps, no cities in the country that have better parks and none that enjoy as great an area of breathing space with as little cost to the taxpayers.

Washington Monument. Mt. Vernon Place.

Indeed, Baltimore's breathing spots, numbering forty-seven, with a total of 2,266.22 acres, have cost the city in the neighborhood of but $10,000, which was expended for some new buildings in 1901. Prior to that time, and since, the cost of acquiring park acreage and the maintenance has been taken care of by the street railways.

### A Far-Seeing Mayor

In 1860, Thomas Swann, who was mayor of the city, had before him several applications for franchises to lay passenger railway track in the city. Mayor Swann conceived the idea of stipulating in the franchise that the street railway company should perpetually pay to the city 20 per cent of the gross receipts and that this money be used for the purpose of purchasing and maintaining parks. The franchise was accepted and the first year of the operation of the street cars netted the city $33,000. In later years, however, after several changes in the price of transportation, which had ranged from 5 to 7 cents and charges for transfers, by a vote of the people in 1870 the cars were permitted to run on Sunday and there was a readjustment to the present fare of 5 cents with free transfers and a tax of 9 per cent on the gross receipts.

These gross receipts are increasing annually and the 9 per cent tax for 1911 brought to the coffers of the park board $514,697.56. In addition to this revenue the park board has an annual rental income from privileges that brings in about $3,000, while a similar amount is derived from the sale of hay, sheep, deer, worn-out equipment, etc., all of which brings the grand total up to about $600,000.

### A Park System

In 1903 the Municipal Art society, a public-spirited organization that has been responsible for a number of excellent beautifications, employed Olmsted Brothers to visit Baltimore and to make a report, not upon the park system as it then existed, but upon what should be done for future development.

Messrs. Olmsted spent several months on the work and their report, issued in 1904, was such that it was adopted by the park board, which not only insisted upon paying for the report, but determined to carry out, as rapidly as warranted, the recommendations.

This new system at once gave to Baltimore something definite to work upon and the carrying out of the Olmsted plans is now in progress. To jump right into the work, to acquire necessary land and to make permanent improvements the people of Baltimore voted a loan of $1,-

DRUID HILL PARK, BALTIMORE, MD. *Main Entrance.*

000,000. This loan, incidentally, will not have to be repaid by the people, but will be taken care of by the annual street car tax.

Having always had at its command a fund of ample proportions, the several park boards have never been niggardly in their expenditures. The result is that Baltimore today has as beautiful parks as any city in this country. For natural beauty Druid Hill park, with its seven hundred acres and scores of miles of splendid macadam roads, has long been acknowledged the finest natural park east of the Mississippi river, while Mount Vernon place, at the base of Washington's monument, ranks as one of the most beautiful spots of its kind in this country.

### Historical

The entire history of Baltimore's park system is interesting. Every step that has been made since Dr. George Buchanan wrote an open letter on June 22, 1790, indicates the spirit of unselfishness and generosity of those who have helped to make the city's great park system possible.

Dr. Buchanan's plea for a park was based upon the idea that children should have proper playgrounds. His letter was hardly published before Colonel John Eager Howard threw open his large wooded estate on the edge of the city and invited the people to use it.

For half a century Colonel Howard's estate, then generally known as Howard's park, served the public purpose.

In 1812, the city bought its first public park, comprising about an acre of ground on which is now Calvert street. This land and improvements cost $27,000. In later years, however, when the park was abandoned and sold, this expenditure was made good.

In 1827, William Patterson deeded to the city 37 acres of land which was then a mile or more beyond the eastern limits of the city. The city rapidly grew toward this park and the city authorities, looking to the future, kept adding to it until today the park contains 128.44 acres; also, it is now surrounded by dwellings and is in the corporate limits.

The acquiring of Druid Hill park is one of the incidents that will always stand out brightest in the civic history of Baltimore.

In 1860, Mayor Swann appointed a commission to acquire for Baltimore a park

*Conservatory on Main Driveway.*

*Mount Royal Avenue, leading to entrance to Druid Hill Park.*

*Broadway, with Eastern Female High School on left.*

that would be worthy of the name. This commission selected the 500-acre estate of Lloyd N. Rogers, a property that at that time ranked as the finest private estate in America. The price that Mr. Rogers wanted, $510,000, was acceptable to the commission, but Mr. Rogers didn't think enough of Baltimore to take more than three-quarters of his payment in city stock, demanding the remainder in cash.

BALTIMORE'S PARK SYSTEM, PRESENT AND PROPOSED. *Solid black indicates public grounds. Shading indicates proposed public grounds.*

A. *Black River Reservation, partially acquired.*

B. *Curtis Creek Reservation, none acquired yet.*

C. *Loch Raven, site of new water works, to be parked.*

D. *Patapsco Gorge, partially acquired.*

E. *Green Spring Valley, a suburb given over entirely to magnificent private estates.*

*Eutaw Place, leading to entrance to Druid Hill Park.*

*Lafayette Square.*

*Harlem Park.*

*Madison Square.*

*Johnson Square.*

*Lake for Boating and Skating.*

*Spring fountain in Clifton Park.*

*A woodland scene in Wyman's Park.*

The difficulty of raising the cash was overcome by Mayor Swann and ten other citizens subscribing $10,000 each.

It is gratifying to read that this stock rejected by Mr. Rogers immediately jumped in value. When the stock became due in 1890, it was not only redeemed by the sinking fund that had been provided thru the taxation on the street railways, but this fund placed to the credit of the park board a balance of about $175,000. From time to time the area of Druid Hill park has been increased until it now contains 672 acres.

### Parks are for the People

The parks of Baltimore are for the people. Save in the small squares and at the entrance to the large parks the "Keep-off-the-Grass" signs are conspicuous by their absence. In all of the parks are picnic groves, tennis courts, baseball diamonds and heaps of sand, the latter for the toddlers. The Baltimore Playground association and the Baltimore Public Bath commission carry on their work with the co-operation of the park board.

In Patterson park, there is a modern athletic field with swings and other apparatus and a bathing pool.

# A NOVEL BRIDGE

*By J. O. Bashford, Tacoma, Wash.*

THERE has just been completed at Tacoma, Wash., a steel lift bridge that presents several new features in engineering. It is believed to be the first bridge built with a lift span lower at one end than at the other. This lift is 214 feet between piers and is 5½ inches lower at one end than at the other.

Work on the construction of this bridge was begun about eighteen months ago. The bridge spans the city channel at Tacoma and connects the manufacturing district with the business center. It replaced a steel bridge, constructed a number of years ago and which had outlived its usefulness.

In order to keep the way open for traffic it was necessary to use the old bridge while the new one was under construction. To do this the contractors built a temporary bridge beside the old one but crossing it so that its ends are on opposite sides of the old bridge. The old draw span was left intact and was swung at an angle to connect the ends of the temporary bridge. While this was under construction work was under way on the concrete piers for the new bridge, on which about 1,200 yards of concrete were used. They were sunk fifty-five feet below the channel bottom to a firm foundation. The tops of the piers are over 70 feet across.

One of the approaches to the bridge leads from a high bluff and the approach from that side, with the lift is on a 2½ per cent grade.

The lift span, which weighs 800 tons is handled by a 60-h. p. motor. The counter weights, which are of concrete, weigh 400 tons each and are held by 64 steel cables; 16 of these cables at each corner measure 1½ inches in diameter. The span is 60 feet above the water at high tide and lifts 75 feet. The span can be raised this distance in 30 seconds. It is also arranged with a hand-power gear for use when the motors are disabled.

NOVEL LIFT BRIDGE *at Tacoma, Wash. Note water pipe at top of lift towers and temporary bridge crossing under the new bridge.*

To solve the problem of handling the heavy water main in this district the suggestion was made to carry the pipe over the bridge. This has been done and a 14-inch water main is swung by a trestle work over the top of the main lift and carried 213 feet above the surface of the water below.

The bridge was built by the International Contract Company at an estimated cost of $500,000. It was designed by Waddell & Harrington, of Kansas City. The steel was furnished by the American Bridge & Dredging Company.

# TAKING CHANCES ON A SEWER TRENCH

THE necessity of eternal vigilance in sewer excavation is emphasized by a fatal accident on a sewer trench in Birmingham, Ala., on the evening of January 3, 1913.

FATAL ACCIDENT *in Birmingham sewer trench; view of cave-in on each side of trench, earth surcharge on left, and water pipe, partly suspended in trench and partly dropped out. Photograph taken while digging for buried laborers.*

The city is constructing a 5-foot main outlet sewer of brick, nearly all of which had been completed. The contractor was working on a section connecting the constructed line on the lower, southeastern side of the street railway line between Birmingham and South Ensley and the completed upper line on the northwestern side of the Pike Road paralleling the tracks, as shown on the accompanying photograph of the plan of the same. The curves in the road were excavated and in process of excavation with a depth of cut of about 20 feet. The street railway tracks are 3 or 4 feet lower than the level of the road in the vicinity, as shown in the cross section of the cut.

The soil, as may be seen by the photographs of the trench taken after the accident, is stiff and clayey and stands vertical under almost any conditions for any depth of excavation. The only bracing observed was some 12-inch planks set vertical and several feet apart, with light cross braces sufficient to hold them in place, but not sufficient to resist any material motion of the earth.

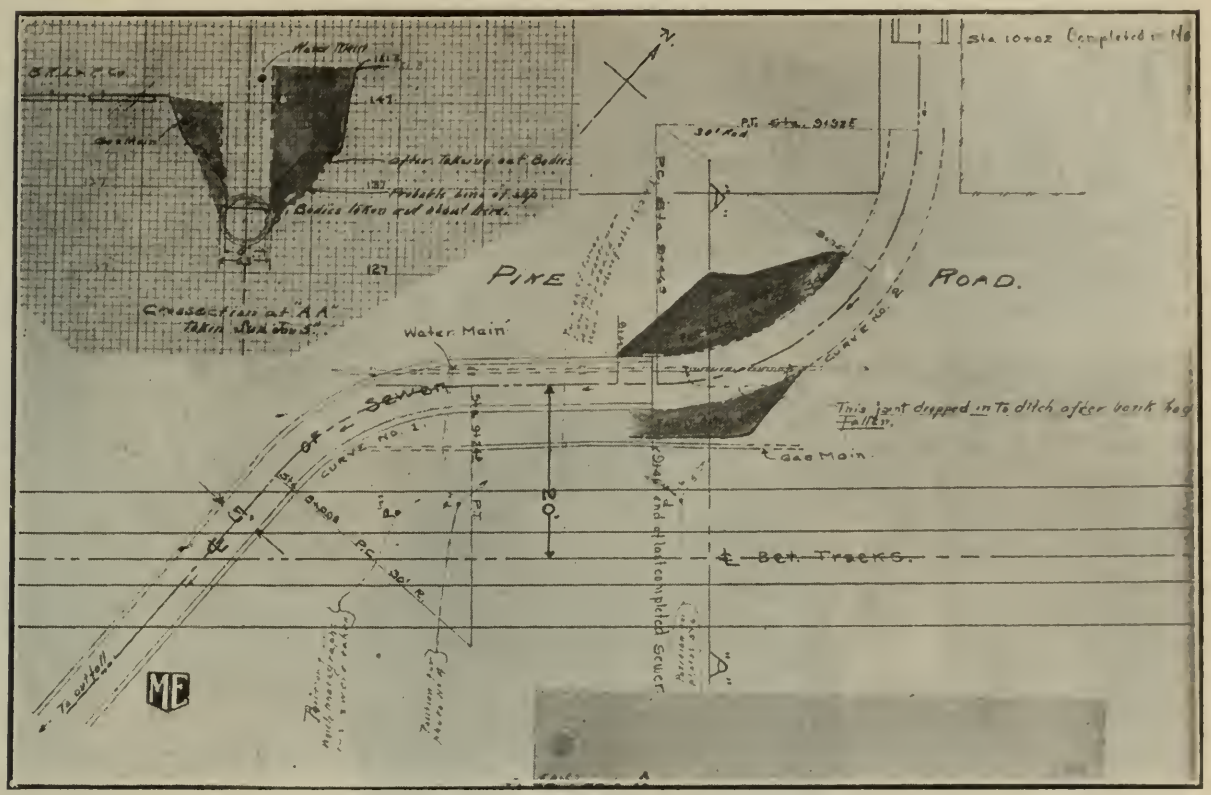
The Pike Road was closed to travel, but cars were running regularly on the street railroad tracks. There had been considerable rain at frequent intervals for some time prior to the accident and on the afternoon of January 2 there was a particularly heavy rainstorm which seems to have caused the small slide on the side next to the car tracks. The old trench for the gas main and the vibration due to the passage of cars doubtless aided in causing this slide, which was not serious, nor did it lead to any effort to brace the trench thoroly. On January 3 only a few minutes before quitting time in the evening the heavy slip occurred, which buried about 20 negro laborers, six of whom were killed. It required all of the next day to recover the bodies. The writer saw the trench on Sunday, January 5, the day on which the measurements for the accompanying cross-section were taken for the city engineer's department, as shown by the full line marked "After taking out bodies."

As shown in the plan, section and photograph, a water pipe was located in the trench and was supported by timbers across it. One unsupported length of this pipe dropped into the ditch after the bank slipped in under it. The earth excavated from the trench was all thrown out into the road on the higher side of the trench. The plan and profile are self-explanatory.

The accident seems to have been caused by the softening of the bank by the rain, particularly the heavy rain of January 2, and the heavy weight of the excavated

earth undoubtedly aided in causing the slip. It occurred on the curve where the bank had the least lateral support. Quite possibly the slip would not have occurred if any one of these three contributing causes had been lacking.

The accident is another warning that the sides of excavations cannot be watched too carefully, and the effect of any unexpected occurrence upon their stability must be carefully estimated and provided for.




PLAN OF SEWER TRENCH *in Birmingham, Ala., and sections showing circumstances of fatal accident.*

# CHICAGO BUDGET FOR 1913.

Chicago's annual appropriation bill for 1913, carrying a total of $65,032,124.66, has been passed by the city council. When the last of the changes had been figured out and the new total secured it was found the council had made a net increase of $870,539.31 over the budget as recommended by the finance committee.

The comparative figures of the budget committee as recommended and the appropriation bill passed by the council were:

| | Budget. | Appropriation. |
|---|---|---|
| Corporate Purpose fund.... | $23,384,197.07 | $23,735,909.38 |
| Water fund.... | 8,136,828.70 | 8,271,446.70 |
| Bridge Bond fund ..... | 3,982,646.00 | 4,149,464.70 |
| Contingent on Bonds ..... | 5,623,220.00 | 5,623,220.00 |
| From Traction Deposits .... | 184,000.00 | 184,000.00 |
| Sinking fund... | 1,829,609.58 | 1,829,609.58 |
| Public Lib..... | 851,640.00 | 851,640.00 |
| Tuberculosis Sanitarium .. | 945,000.00 | 945,000.00 |
| School Purposes | 18,941,250.00 | 18,941,250.00 |
| Voting Machines ..... | 283,335.00 | 585.00 |
| Totals .... | $64,161,545.35 | $65,032,124.66 |

The only figures changed by the council were those of the corporate and water funds and the bridges. All others remained as the committee had recommended. The coporate appropriations were increased $352,296.31, water, $134,618, and bridges, $167,000.

The big increase from the corporate fund included $211,303 for park judgments, $63,895 for police, $5,140 building department, $4,864 board of local improvements, $11,062 special parks, and $69,144 electrical department.

# GUARDING AGAINST ACCIDENTS

*By Robert J. Young, Manager Department of Safety and Relief, Universal Portland Cement Co. and Illinois Steel Co.*

THE following article has a direct bearing upon the work of every contractor and employer of labor where the men have more or less influence upon each other's safety. One main idea is continued advertisement of the possibilities of guarding against accidents and making men familiar with them so that they will always know what to do, and more important still, what not to do. Another is emphasis of the importance of guarding against accidents which is a state of mind into which the contractor must first put himself, then force his superintendent and foremen into the same state of mind, when the men will follow. While but little of the apparatus shown is applicable in any one case the spirit is applicable everywhere, and that is the spirit of this article. [EDITOR.]

The desirability of preventing industrial accidents is receiving a great deal of deserved attention, and for a number of years the subsidiary companies of the United States Steel Corporation have been carrying on a campaign for the safeguarding of machinery and other dangerous places, under a committee known as the "Committee of Safety of the United States Steel Corporation," which was appointed in March, 1908.

*Robert J. Young.*

In handling this work the Universal Portland Cement Co. has divided it into three closely allied headings, viz.:

1. The Safeguarding of Dangerous Places.
2. The Promulgation of Rules for Safe Operation.
3. The Inculcation of Habits of Caution in the Minds of All Concerned.

### The Safeguarding of Dangerous Places

It might be said in this connection that although statistics show that failure to guard dangerous places is not the most prolific source of accidents, carelessness in this regard has a most marked effect, consciously or unconsciously, upon our thoughts and actions, and is, therefore, conducive to reckless habits.

What folly it would be to try to enforce or train the workmen into thinking of their own or others' safety, if we did not show our desire to prevent accidents by doing all in our power to make the working conditions as safe as possible.

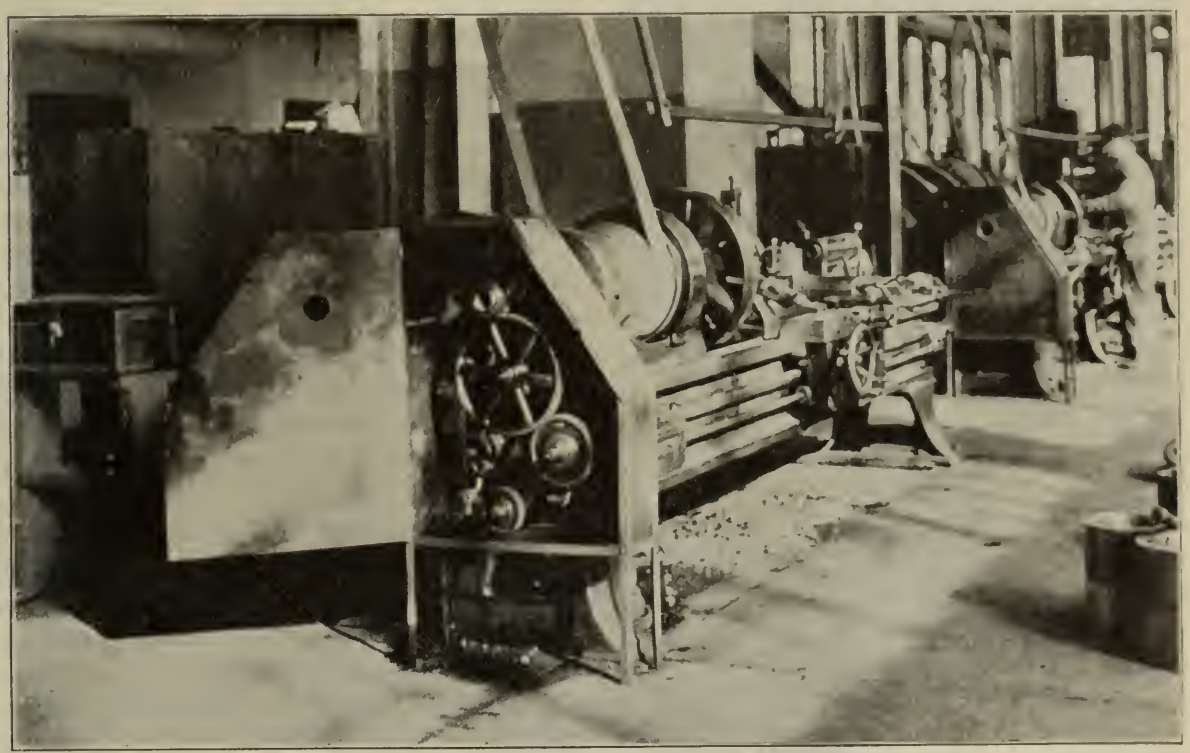
There has been a gradual development in the working out of these safety appliances. When a new kind of guard is devised, it is tried out at one of the plants until it is proven that it is efficient and practicable, and is then installed at the other plants. In this way the installation of efficient, standard guards is insured.

Every precaution is taken to safeguard workmen from injury from electrical equipment and electric current. One or two selected pictures show devices which will be of value to any one using such apparatus, and are fair examples of the many devices which have been installed.

Every motor thruout the plants is controlled by an oil switch, and an arrangement is provided for locking the switch in the open position with a padlock, as shown in cut No. 2.

This makes it impossible for any one to start up the machinery on which a re-

pairman has work to do until he is thru and has removed his padlock. If, for instance, a machinist and an electrician were both working on machinery controlled by the same switch, there would be two padlocks on this switch so that the electrician, for example, would not have to depend upon the machinist for his safety.



*Method of Guarding Lathe Gears.*

Cut No. 1 illustrates a lathe guard in machine shop. It is required that gears shall be covered on the sides as well as on the face and that the guards shall cover the wheels to such an extent that the danger from being caught between the end of the guard and the wheel will be eliminated.

Contractors should feel the importance of protecting their workmen from exposed gears on concrete mixers, pumping engines, hoists, etc.

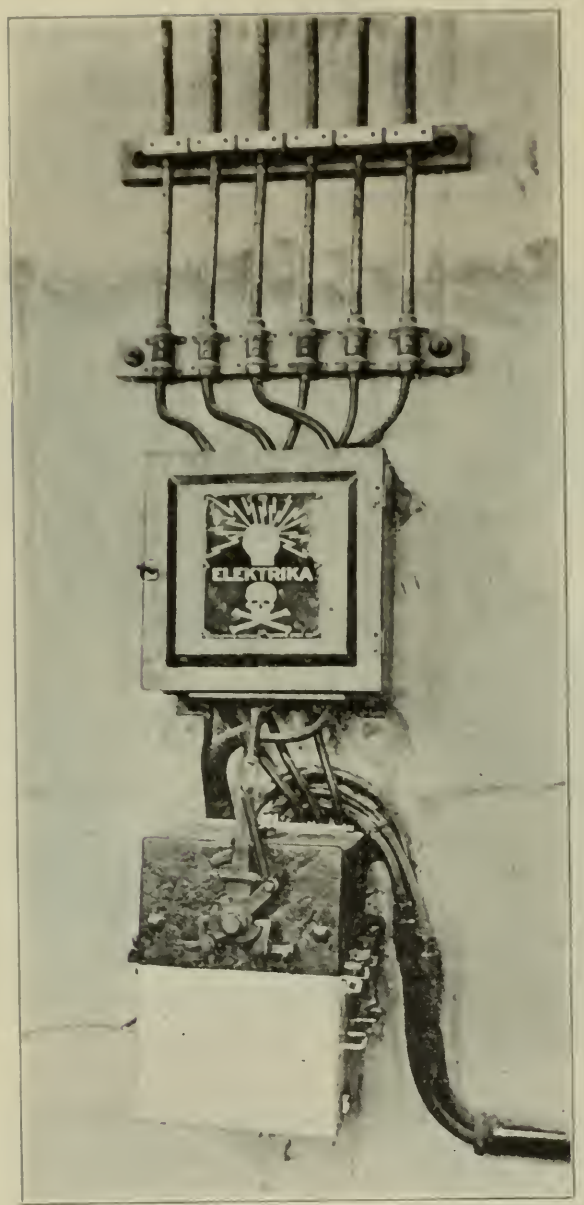
### Promulgation of Rules for Safe Operation

All men are employed thru an employment office. When a man comes to the office for a job he is confronted by a sign telling him that unless he is willing to be careful of his own and others' safety he should not ask for employment.

Every man passing thru the employment office is given a rule book printed in his own language. The Workmen's Rule Book sets forth the rules and precautions that should be observed to prevent accidents. The Superintendents and Foremen's Rule Book, in addition to containing these rules, also contains construction rules, governing the construction and installation of machinery and the physical conditions to be maintained. It sets forth how gears, shafting, belts and pulleys, etc., shall be protected; what protections are required on cranes; how stairs, platforms, railings, etc., shall be constructed; in fact, setting forth the standard safety devices adopted by the company.

### Inculcation of Habits of Caution

The care exercised by the workman largely enters into the number of accidents occurring in any plant, and the only way the number of accidents due to carelessness can be reduced is by the inculcation of habits of caution into the minds of the men. The burden of doing this must rest almost entirely upon the management of a plant or department. The superintendent's attitude and the foreman's attitude toward the prevention of




*Lock for Switch and Danger Sign.*

accidents will be reflected by the workmen just as accurately as their attitude toward the getting out of finished product is reflected. If the superintendent treats the matter lightly, his assistants will treat it lightly. If he shows a strenuous desire to have working conditions safe and precautionary rules observed; if he makes the prevention of accidents one of the most important features of his department, then his foremen will reflect that feeling and will see that the men observe the precautions which are known to be necessary to the prevention of accidents. By seeing that the men observe these precautions and by talking with them about the necessity of keeping conditions safe, they will inculcate such habits of caution that the number of accidents occurring in that department will be reduced to a minimum.

One of the plans to catch and hold the interest of the men and at the same time insure the installation and use of safeguards and the stamping out of dangerous practices is the organization of safety committees in each plant or mill, consisting of the assistant superintendent, who acts as chairman, and an operating, a mechanical and an electrical foreman. This plan can be modified to suit the conditions of the employer of labor on any work where there is danger of accident.

Regular inspections are made monthly, and in the manner of making these inspections lies the feature which has proven to be an incentive to the committee members to always have their mills in good condition.

The management has caused to be made a badge of distinction which is presented to each man showing a thorough knowledge of the safety rules. The workmen, as well as foremen, compete for these badges. It is, however, compulsory upon the foremen to take an examination on the rules and precautions governing the prevention of accidents. In order to obtain a badge it is necessary that an examination be passed with an average of at least 90 per cent. efficiency.

When records are made in production or for any reason cigars are distributed, they bear the "Universal Safety" band. If a man has distinguished himself in any way to promote safety he is rewarded with a box of the "Universal Safety" brand.

The department of safety and relief issues each month a Safety Bulletin treating on accident prevention.

The names of all members of safety committees are shown in this bulletin, with the request to workmen to help these men keep the dangerous places guarded and stop dangerous ways of doing work in order to raise the "batting average" of the plant in the Accident Prevention League. An accident chart is shown, giving the standing of each plant, showing the champions at the top, and a

"score card" is run from month to month, remarking on any changes that may take place in relation to the standing of the plants.

The bulletin also sets forth accidents that have occurred recently and points out how they can be prevented.

Cuts of safety devices designed by foremen and workmen are illustrated, and credit is given to the man who has interested himself enough in this work to devise means of preventing accidents.

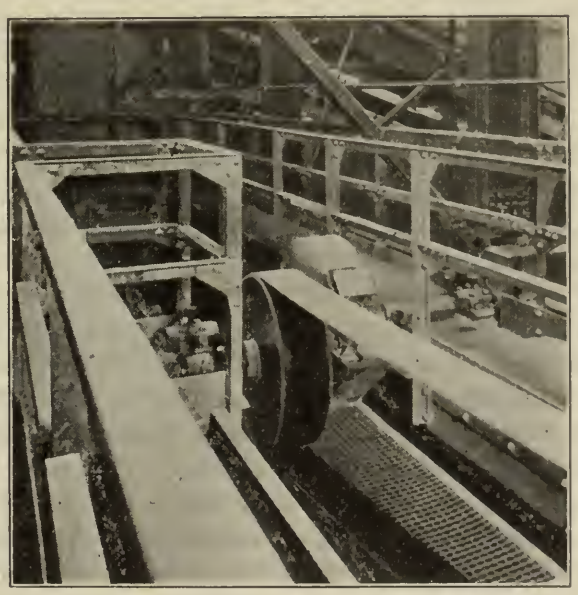
Known cases where safety devices have prevented accidents are reported, and in fact anything is put in which it is thought will interest the men and keep them "boosting for safety."

**Results**

That is what we are all interested in.

You frequently hear that accidents are inevitable—that they are bound to happen and that little can be done to prevent them, as the human equation is such a large factor in their occurrence.

The records of the Universal Portland Cement Co. show that thru an organized effort in guarding dangerous places, promulgating safety rules and interesting the workmen in their own and others' safety, great strides can be made in accident prevention. The accidents in that company since this organized effort was inaugurated have been reduced 66 2/3 per cent.



*Guards for Gears, Shafts and Falling Articles.*

# DESIGN OF ROAD AS AFFECTED BY TRAFFIC

THE amount and character of traffic are both of the utmost importance to the life of a road and information about both is essential to a successful design.
both is essential to a sucessful design.

The engineer can design a successful pavement for horse-drawn traffic alone or for automobile traffic alone, and he can do the same for a country road if he takes sufficient account of the loads carried by the commercial vehicles. A city street must be designed to carry reasonably heavy loads and the speed of automobiles is kept down to a reasonable rate, so that on the one hand the weight is taken care of and on the other the speed need be considered but little, if any.

But when the engineer desires to make an economical design for a country road to carry both kinds of traffic, he is in trouble. He must have the fullest information about the kind of traffic, the number of vehicles, the weights carried, the widths of hard tires, the number of horses, the speed of automobiles, with details as to each, that he may make the necessary comparisons and allowances for the various factors of wear which affect the surface of his road so differently. Not only this, but he must turn prophet and predict the effect which the improvement of the road will have upon the traffic of the future, otherwise he may find himself in the condition of many English road officials, who are now asking for grants to strengthen the foundations of main country roads on account of the large development of heavy steam lorry and commercial automobile traffic, both heavy, and, in the latter class rapid in character.

### Effects of Traffic on Roads

In a recent discussion of the traffic census, in its relation to road design, Professor A. H. Blanchard gave some interesting results of observations:

"The first case is that of a water-bound macadam road, located in an isolated district, and subjected to a traffic of 150 motor cars and fifty horse-drawn vehicles per day. The motor cars consisted of heavy touring cars, which travelled at speeds of 30 to 50 miles an hour. Within six months after construction the wearing surface had disintegrated to such an extent that the cost of reconstruction amounted to practically $1,000 per mile. It is self-evident that if a macadam surface on a residential street in a city had been subjected to this amount of traffic, moving at a speed of not greater than 20 miles an hour, very little disintegration would have taken place.

"The second example is that of a macadam road constructed of shale rock and finished with a bituminous surface in connection with which a heavy asphaltic oil was used. The road was subjected to a large amount of motor car traffic during the summer months and during this period gave entire satisfaction. In winter, however, the traffic included heavy horse-drawn vehicles used for hauling logs. As the horses were equipped with sharp calks, the effect of drawing heavy loads upon the above surface was disastrous. The road in the spring was full of holes, some of which were twelve inches in depth. The above emphasizes the value of taking a traffic census at different seasons of the year and also the value of a thoro investigation of the character of the traffic by consultation with the various interests using the highway.

"As the third illustration will be cited the case of a bituminous concrete pavement, subjected to a total traffic varying from 500 to 1,000 vehicles per day, the horse-drawn vehicles and motor cars being about equal in number. The bituminous cement used in the mix was a coal tar. The pavement was not furnished with a seal coat. The result of winter

traffic for five months was the disintegration of the surface, consisting in the formation of many pot holes. An adjacent section on which a seal coat was used was in excellent condition at that time. The disintegration in the above instance was due entirely to the horse-drawn vehicle traffic, as the blows from the horses' hoofs loosened the individual stones in the open mosaic surface of the pavement.

"The fourth example is that of a water-bound macadam road built of trap rock, which highway was subjected to a daily traffic of fifty motor cars and 100 horse-drawn vehicles. This road ravelled continuously during dry spells, due to the insufficiency of the dust, formed by abrasion, which was required to bond the road. On the other hand, a macadam road, similarly constructed, subjected to twenty-five motor cars and 225 horse-drawn vehicles per day, remained in an excellent condition. Of the 225 horse-drawn vehicles, 150 were commercial vehicles, which naturally tended to produce a certain amount of dust by abrasion and to compact the surface.

"The last illustration to be cited is that of a water-bound macadam road upon which was constructed a mat surface, formed by using a heavy asphaltic oil and stone chips. Under a traffic of 300 horse-drawn vehicles and 400 motor cars per day, the mat surface crept, forming a waxy surface. Many holes developed, caused by the blows of horses' hoofs on the mat surface.

"It is evident from the above illustration that it is also essential to keep accurate records after the construction of roads and pavements in order to have at hand complete data upon which to base the design of wearing surfaces of highways to be constructed under similar conditions."

### The Information Necessary

Professor Blanchard makes a definite classification of the most essential information concerning the traffic, to be used in judging the suitability of a constructed road for the traffic upon it, as a basis for future designs, and in deciding the character of design to be adopted for a new road surface. In the latter case the estimates of future changes must also be made. We have but few histories of constructed roads, on which to base these predictions, and they are, therefore, largely guesses, with a little basis of more or less accurate observation and summation of experiences. Professor Blanchard's classification is as follows:

"(1) Differentiation between horse-drawn vehicle traffic and motor car traffic.

"(2) Division of each of these classes of traffic into pleasure and commercial traffic.

"(3) Subdivision of commercial traffic into loaded and unloaded vehicles.

"(4) Determination of the weight per linear inch of width of tire of all types of commercial traffic.

"(5) Subdivision of the two classes of horse-drawn vehicle traffic, dependent upon the number of horses.

"(6) Subdivision of pleasure motor car traffic upon the basis of weight and speed, since, in many instances, the greatest damage to certain types of roads is caused by seven-seat touring cars, limousines or landaulets, traveling at speeds of 40 to 60 miles an hour.

"(7) Extraordinary character of local traffic; for example, traction engines hauling trailers, motor bus traffic, ice wagons, mill drays, etc."

# Wood Preservation with Asphaltic Material

In an article entitled "Asphaltic Oils Economical Wood Preservers," published in Municipal Engineering, vol. xl, p. 411, Frank W. Cherrington reports the success of the Sante Fe Railroad in treating ties with natural asphaltic oils from California and Mexico to prevent decay. The result is a tie with probable life of 18 to 24 years, while untreated ties of the same and better kinds of timber were removed from the track in about 6 years.

He also shows the value of refined asphaltic oils from the Central States for the same purpose. The inflammable and volatile portions having been removed by the refining process, the oil is more dense and stable than the natural oils. It has about 65 per cent asphaltic content as compared with 75 per cent in the California and 80 per cent in the Mexican natural oils. The refined oil has cementitious or adhesive qualities, which bind the fibers and cells of the wood together, strengthening it and considerably reducing the tendency to check, as well as waterproofing it and preserving it.

Mr. Cherrington has continued his studies of the oils and their use in wood preservation, and states that the results demonstrate that an antiseptic germicide is not essential when the timber is thoroughly waterproofed by an asphaltic substance which entangles and enmeshes any germ life which may be present and prevents the entrance of any fauna or flora destructive to wood.

His comparative analysis of the three oils shows flash and fire tests of the refined oil 220 degrees or so above the Mexican crude oil and 140 or so above the California oil. Density is over 7 degrees Beaume above either. Specific gravity is 0.048 to 0.046 less. Loss on distillation is zero up to 300 degrees Centigrade, whereas Mexican oil loses 20 per cent between 150 and 300 and California loses 15 per cent. Evaporation at 140 degrees F. is zero and at 200 degrees is but 0.132 in 96 hours; whereas Mexican oil loses 6.8 to 11.4 per cent and California oil 2.3 to 11.5 per cent, according to temperature and whether 24 or 96 hours exposure.

At 100 degrees F. the Mexican oil has a viscosity of 3000 with Scott's viscosimeter, the California oil 1565 and the refined aspahltic oil 100, showing that the latter is much easier to handle by pumping in pressure plants. In fact, there is little or no trouble in so handling the oil in the plants in which it has been used. The viscosity of the crude oils decreases very rapidly to 150 degrees and less rapidly thereafter, and at 250 degrees the three are not far apart, being 40.5, 22 and 16, respectively.

The asphaltic oils of the Central States can be used in producing this refined oil, but the crude petroleum of the Eastern States does not have an asphaltic base and can not be so used.

Asphaltic oils, says Mr. Cherrington, must be injected in quantity such that the wood will refuse to absorb any more to have value as a timber preservative. In practice, pine ties absorb from 8½ pounds per tie when of dense heart wood, to 80 pounds when almost entirely of sap wood. The two ties have about the same life, notwithstanding the great difference in amount of preservative used. The average injection is about 40 pounds per tie.

The absorption per cubic foot, treated to refusal, in various timbers is shown in the following list:

| | |
|---|---|
| Hardwood Special | 3.48 |
| Sap Pine | 3.00 to 7.27 |
| Seasoned long leaf pine | 9.54 |
| Birch | 2.42 |
| Gum | 9.10 |
| Red Oak | 8.66 |
| Beech | 5.45 |
| Seasoned Elm | 9.10 |
| Seasoned Birch | 4.53 |
| Seasoned S. Elm | 16.06 |
| Seasoned Gum | 15.45 |
| Seasoned M. Oak | 4.83 |

| | |
|---|---|
| Seasoned Pa. Pine | 9.70 |
| Green Yellow Pine | 8.18 |
| Hardwood Special | 5.45 |
| Seasoned Beech | 9.40 |

Three runs of about 500 ties each, mixed timbers, averaged 8.3, 7.5 and 9.3 pounds per cubic foot absorbed, respectively.

Samples cut from the ties showed penetration not so good in beech, birch and maple (hardwood special), fairly good in red oak, and excellent in loblolly and sap pine, the sapwood being completely impregnated.

The maximum amount of oil absorbed is not prohibitive on the score of cost, and the average is very reasonable. The treatment to point of refusal injects a maximum of the preservative material, which by the exclusion of moisture prevents the entrance from outside of organisms causing decay, and prevents the growth of those within the tie.

The time required to treat timber with the asphaltic oil is about 3 hours, 10 minutes, 7.58 charges per day being possible. The approximate time required to treat the same timber with 8 pounds of creosote per cubic foot is 2 hours and 35 minutes. The reduction in output of the treating plant is asserted by Mr. Cherrington to be more than made up by the marked increase in the life of the timber under the full-cell treatemnt with asphaltic oil to refusal.

The increased use of treated paving blocks makes this an important branch of wood preservation. Some city specifications demanding the use of creosote oil, with a specific gravity ranging from 1.03 to 1.1, and designating an injection of 20 pounds per cubic foot, require that after treatment the block shall show such waterproof qualities that after being dried in an oven at 120 degrees F. for 24 hours, weighed and immersed in clear water for 24 hours and weighed, the gain in weight shall not be greater than 4 per cent. A wood block treated with 16 pounds per cubic foot of refined asphaltic oil, submitted to the same test showed a gain of but two hundredths (0.02) of one per cent.

Waterproofing wood paving blocks is of the utmost importance not only to prevent decay, but especially to prevent damage by buckling of pavements. It is reasonable to assume that as good results can be obtained in preserving wood paving blocks with asphaltic oil, specially prepared, as with railroad ties. Mr. Cherrington therefore urges engineers and city chemists to investigate the asphaltic oils as materials for wood preservation. They are obtainable in enormous quantities at low prices and within easy reach of most consumers.

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*Design of waste can, as adopted by the committee on streets, Minneapolis Chamber of Commerce, with which the city will probably be equipped in the near future.*

# THE CIVIC CENTER OF DES MOINES

*By George Bate Lord, Secretary of the Commercial Club.*

THE Des Moines river comes down thru the business center of Des Moines, Iowa. The government years ago patented the area within the meander lines to the state and the state in turn patented the portion of the river bed within the city to the city for park purposes. For years nothing was done with the river. Junk dealers, cheap boarding houses, barns of one of the express companies, etc., occupied the river front and encroached upon the city's property.

Five years ago a committee of the Commercial Club, known as the Civic Improvement committee, started to create sentiment for river front improvement and the creation of a civic center. It induced the city to bring ouster suits against the trespassers and to acquire by purchase or condemnation all of the land between the river and First street east and First street west. This cost the city about $100,000. Next it sought improvements.

### Handsome Buildings Come First.

The public library was the first building to go to the river front. It cost about $300,000. The government postoffice, costing $500,000, followed. Then came the Coliseum, costing $165,000, and then the new city hall, costing $450,000. A Federal court house, to cost $350,000, is now in sight and a movement is on foot to remove the State Soldiers' and Sailors' monument from its present location a mile east of the business center to the river front. As occasion demands them we will seek to locate other public building along the river bank.

### Bridges and Lake Follow

This year $65,000 was expended for acquiring land in this district and $35,000 for parking, building a river wall, etc. The Civic committee raised $8,000 in subscriptions of $10 and $25 each with which a dam was built below the center to hold the water to a stated level in this center at all times. In the five years two

PLATE III. *The two blocks shown in Plates I and II as they appeared in 1912 with the new municipal building.*

PLATE I. *The east river front between Locust and Walnut Streets in 1909.*

PLATE II. *The east river front between Grand and Locust Streets in 1909.*

of four old overhead truss bridges have been removed and replaced by concrete arch bridges, as shown in the views. In the next three or four years we expect to replace the two other bridges with concrete structures. We also expect to make available for boating from the civic center, by using a submerged electric lift to get over a dam at Center street, a lake formed by this dam ,which extends up the river for six miles. Already the railroads are co-operating. These cross the river just below the civic center and a view of it is to be had from all trains coming into and leaving the city. They are replacing old truss bridges with panel bridges.

### More Area Secured

Up stream the city has acquired by purchase and donation a strip along the west bank of the river from a width sufficient for a boulevard drive to one of several hundred feet along the river. On the east bank a park of a couple of hundred acres has been acquired extending for nearly a mile along the river. From this park west to Waveland and Greenwood parks, about three miles distant, the Civic committee has secured dedications without expense to the city of 35 acres of right of way, so distributed as to permit of the building of a boulevard. This extends along either side of a water course and thru heavily timbered ravines, where there is a natural water grade that will call for but small expenditure for grading.

The accompanying photographs show the area of the civic center before im-

PLATE IV. *The west river front, showing the new Public Library and the Coliseum from the Walnut Street Bridge.*

PLATE V. *The west river front from Locust Street Bridge, showing night view new Postoffice, Bridge and River Front Park.*

provement and its appearance at the present stage of the improvements.

Plate I is of the east river front, between Locust and Walnut; Plate II is of the east river front, between Locust and Grand; both taken three years ago. Plate III is of these two blocks as they now appear with the new municipal building.

Plate IV is of the west bank, showing the library and Coliseum. Plate V also shows the west river bank, type of bridges and character of park improvement work, with the new postoffice in background. Des Moines has an extensive ornamental street lighting system and the last two photographs are night views.

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# REGRADING RINCON HILL IN SAN FRANCISCO

The San Francisco Chamber of Commerce proposes to grade down Rincon Hill, which interferes materially with the use for mercantile and industrial purposes of the area most convenient to the new southerly extension of the docks in the harbor. At least three plans for the work are proposed. By the most extensive plan the area to be graded down is twenty-five city blocks. The maximum depth of cut on this plan is 61 feet at Harrison and First streets. This plan, which is most in favor, will affect 779 separate parcels of property with 725 different owners. It will require moving 2,861,800 cubic yards of material at a cost of $3,577,050, from these properties, which have an area of 4,578,369 square feet. Assuming that the tax assessment is made on a basis of 50 per cent., this property is worth $8,818,020. It is estimated that the regrading will increase this valuation 75 per cent., or $3,000,000 more than its cost. Besides this cost for the work on private property there will be required excavation of 1,100,000 cubic yards of material from the city streets lowered at the same time, and $314,800 for reconstructing the public improvements affected, sewers, sidewalks, pavements, curb, parks, etc., or a total of $1,689,800, which is covered nearly twice by the profit in the increased valuation of the private property.

# MUNICIPAL LIGHTING PLANT OF TROY, OHIO.

*By L. A. Pool, Superintendent.*

THE evolution of electric lighting and power, which has been so marked during the last twelve years, with the wonderful changes and improvements in apparatus and methods, has been very distinctly demonstrated in the career of the Troy municipal electric light plant.

L. A. POOL.

The city of Troy was originally supplied with current for lighting and power by a private corporation known as the Troy Electric Light and Power Company, who were hampered in their service with the usual grade of inefficient and inadequate apparatus on the market at that time.

They had to contend with the old style equipment of small boilers, high speed engines and generators and, to a great extent, inexperienced labor, which, with a high rate of charge for current, naturally worked up an agitation for the city to have a plant of its own. This dissatisfaction on the part of the citizens finally culminated in the purchase of the franchise and equipment of the private company by the city in 1897, for which it paid $27,500.

The council immediately reduced the rates from 15 cents to 8 cents per kilowatt for metered current and from 85 cents to 40 cents per month for each 16 c. p. lamp.

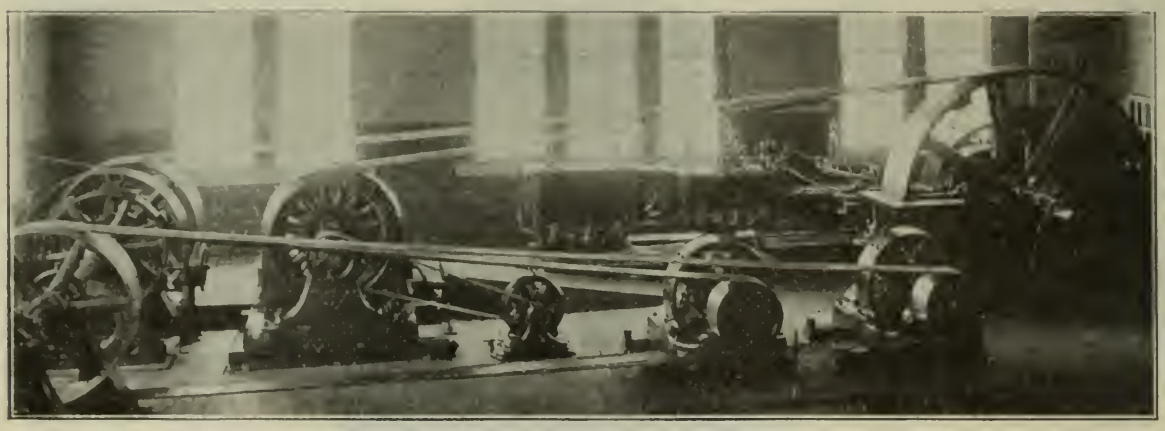
The plant, by hard struggling, increased in capacity and output each year under the management of competent boards of control until the years of 1903 and 1904, at which time a new board came into control of the plant, of whom a majority were opposed to the municipal ownership of anything and political disturbances ran rampant during the two years of their term of office. The possibilities of what the city could gain by operating its own plant, under present management, had been so thoroly demonstrated during the four years previous, they could not force the plant to a sale or discredit it, altho they carried the contention into the court in a general lawsuit.

This airing of municipal ownership in general and the city's electric plant in particular, was of great value to the citizens of Troy, who were shown the merits and demerits of the plant, and they have made it a point each election since to pick good, honest, practical business men to manage the city's affairs. With the above exception, Troy's municipal electric plant has been practically free from political influences and the management of the plant has had a free hand in the operation and management, making it possible to hold the same force of employes year after year.

### Boiler Room

The boiler room contains an equipment of three Stirling water tube boilers, arranged in a single row and designed for 150 pounds steam pressure. The ratings of the boilers are: One class "E" of 200 h. p., one class "F" of 260 h. p., and a class "F" 300 h. p., which is equipped with a Roney mechanical stoker. This 300 h. p.

boiler has a heating surface of 2,932 square feet and a grate area of 62.7 square feet, with a steel stack of 60 inches diameter and a height of 120 feet above the floor level. A guarantee on this boiler was made to evaporate 10 pounds of water from and at 212 deg. F. per pound of dry coal, when the stoker is properly operated and fired with coal containing not less than 14,000 B.t.u. per pound.



TROY *municipal light plant, showing two Fort Wayne direct current generators, Fort Wayne alternating current belted generator and Fort Wayne exciter.*

The boilers are fed by two 7x4½x10 Platt Iron Works duplex boiler feed pumps, taking water from a 600-h. p. Cochran feed water heater.

A Stilwell-Bierce jet condenser of 600-h. p. capacity is connected to the exhaust piping from the engines, taking water thru a 6-inch pipe from the Miami and Erie canal just in the rear of the power house.

### Engine Room

The engine room contains a direct connected and a belted engine set. The direct connected unit consists of a 16x34x36 Hamilton cross-compound heavy duty Corliss engine furnished by the Hooven-Owens-Rentschler Company and rated at 540 h. p. at 120 r. p. m. This engine was guaranteed in steam consumption at full load with 150 pounds gage initial pressure and exhausting into a 26-inch vacuum of 14.8 pounds per indicated h. p., 16.4 pounds per brake h. p. and 28.4 pounds per kilowatt at the switchboard. This engine is equipped with a gravity feed oiling system with nickel plated oil cups and trimmings, which gives the engine a very pleasing appearance. A Monarch automatic engine stop is installed on the engine for protection from excessive speeding of the engine.

The belted unit consists of a 400-h. p. Russell tandem compound engine, which was purchased in 1900. This engine is double belted to a 300-k. w. alternator and to a short line-shaft, the engine having an 11-foot flywheel and running at a speed of 140 r. p. m. This engine is of the slide valve type and is not very economical compared with the cross compound Corliss engine.

### Electrical Equipment

Directly connected to the Hamilton cross compound engine is a 3-phase, 60-cycle, 1,150-volt generator, rated at 360 kva., furnished by the Ft. Wayne Electric Works. It is of the revolving field type, taking exciting current from a 20-k. w., 125-volt, 6-pole belted exciter running at 500 r. p. m., the exciter being belted direct from the engine shaft.

A 300-kva. generator of the same make and characteristics is belted to the 400-h. p. Russell engine, with a 7.5-k. w. exciter belted from the shaft of the generator.

From the line-shaft are belted two 75-k. w., 250-volt, direct current power generators, manufactured by the Hobart Electric Company, running at a speed of 700 r. p. m.

The 360-kva. direct connected generator will deliver 180 amperes of 3-phase current at 1,150 volts with a field excitation of 15 k. w. at 125 volts and the full load efficiency is 93 per cent. The exciter of

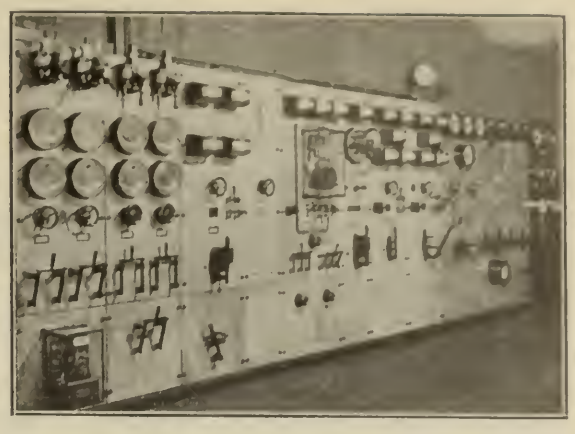
this set has a 4-k. w. capacity in excess of the amount of current required to excite the alternator at full load, operating at 80 per cent. power factor, which is used in exciting a synchronous motor in a motor generator set.

This motor generator set was furnished by the Ft. Wayne Electric Works and is made up of an 8-pole, 150-h. p., 1,150-volt, 3-phase, 60-cycle, revolving field synchronous motor mounted on a common cast iron sub-base and connected by a solid coupling on each end to a 6-pole, 50-k. w., 250-volt, compound-wound, direct-current generator.

This motor, running at 900 r. p. m., takes current thru an automatic oil switch and starting auto-transformer direct from the 1,150-volt bus-bars and the fields are designed for over-excitation for the correction of low power factors. This provision for the correction of the power factor is of great advantage to the plant, as the average power factor of the incandescent lighting system is 86 per cent., which drops to 78 per cent. when the arc lamps and motors are thrown on the line. By a very small expenditure of exciting current, the synchronous motor field can be over-excited and the power factor of the whole system brought back up to 100 per cent. or unity.

### Switchboard

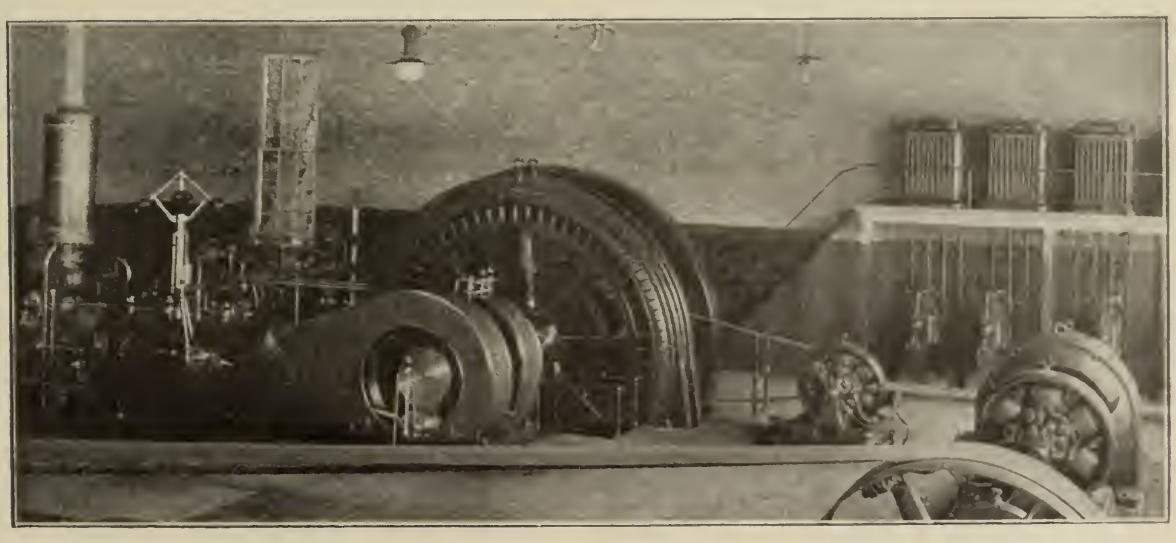
The switchboard is made up of 12 panels and one panel devoted to steam gages and recording instruments, the whole board being supported upon five concrete pillars, on the top of which is mounted an 8 by 10-inch timber, bolted to each pillar, making the switchboard independent of the floor and throughly insulated.



*Controlling and distributing boards in Troy municipal electric light plant.*

The switchboard was furnished by the Fort Wayne Electric Works and has the usual instruments for the proper control of the d. c. and a. c. generators and distribution system and in addition there are provided a Tirrell voltage regulator, frequency and power factor indicating meters, indicating and recording watt meters and automatic oil switches on the distributing lines. On the steam gage board are mounted a Bristol recording voltmeter and Crosby recording steam gage.

All wiring from the generators to the switchboard and from the board to the



TROY *municipal light plant, another view showing generator exciter and motor generator set.*

outside is with lead cables incased in fiber conduit buried under the cement floor of the basement.

### Distribution

The electrical energy for lighting, which is distributed thruout the city at a potential of 1150 volts in six single phase feeders, is transformed thru 80 Fort Wayne transformers to 110 volts for lighting purposes.

Current is furnished at 220 volts, three-phase for power in large installation and 110 volts a. c. and 250 and 500 volts direct for small motors and elevators.

The plant has connected 1,525 h. p. of motors from which a large revenue is derived, 1,050 meters on lighting services, 66 meters on power services and 150 small contract consumers of light and power. The meters are practically all of Fort Wayne manufacture.

The city is lighted with 155 Western Electric 7.5 amp. series enclosed arc lamps, 34 series tungsten lamps (60 watt) and 90 lamps (16 c. p.) in the alleys, arches and public square lamp posts.

### Rates

The rate for lighting current is 7½ cents per kilowatt for all purposes except for sign lighting, which is 5½ cents per kilowatt. Power is furnished for 4 cents for the first 100 k. w., 3 cents per k. w. for the next 300 k. w. and 2 cents for the next 2,000 k. w. The above rates are subject to a discount of 10 per cent. if payment is made before the 10th of each month. A rate of 40 cents per month for each 16 c. p. lamp is charged on contract. The minimum charge for current for meter is 66 cents per month and 50 cents per horse power per month for motors.

### Financial Statement for 1912

The receipts from sale of lighting current for last year, 1912, were $25,228.00; from the current for power, $12,269.00, and for miscellaneous sources, $215.00, making a total amount of $37,712.00. Cash on hand January 1, 1912, $6,096.00.

The expenses for the year were for general administration, $3,168.00; manufacture, operation, $19,829.00; manufacture, maintenance, $2,700.00; distribution, maintenance, $2,037.00, making a total cost of operating $28,037.00.

The improvements put on the lines amounted to $3,800.00, cost of new meters installed, $1,183.00, and cost of new machinery in the plant amounted to $175.00, making a total cost of improvements of $5,158.00. Cash on hand January 1, 1913, $1,613.00.

The plant turned over to the city sinking-fund trustees for the payment of bonds and interest on bonds $9,000.00. The plant did not receive any revenue for the lighting of the streets and city buildings of the city, during the past year.

All collections and disbursements are made and transacted in the office of the director of public service in the city building under the charge of the clerk, Mr. W. B. Freeman and Charles F. Runnells, city auditor.

The electric light and power plant is under the direct control of Mr. G. B. Hatfield, director of public service and the superintendent, L. A. Pool, who has his office at the power house.

A brief financial history of the Troy municipal light plant from the date of its purchase by the city, 1897, to the present time, 1912:

| | | |
|---|---|---|
| Bonds issued and paid by city | $61,500.00 | |
| Interest on bonds paid by city | 23,509.38 | |
| Total expenditures by the city | | $85,009.38 |
| Bonds outstanding (not paid) | | 51,500.00 |
| Bonds and interest paid to date | | $33,509.38 |
| Revenue paid over to the city sinking fund trustees by electric plant for payment of bonds and interest from 1897 to 1912 | | $33,962.00 |
| Net balance in sinking fund for plant | | $ 433.42 |

The above statement shows that the electric plant has paid all bonds that have fallen due and all the interest on

bonds as it became due and have a net balance in the sinking funds of $433.42 to be applied on next year's interest. No notice is taken of other receipts of the plant which have been sufficient to pay all running expenses and the depreciation has been taken care of, to a great extent, by the yearly improvements put on the plant and distribution system, leaving a cash balance to its credit, January 1, 1912, of $1,613.28.

The amount of electric current used for lighting of the streets and different departments of the city during the past year, 1912, for which the electric plant received no revenue, is as follows:

*City Buildings*:

| | |
|---|---|
| Market house, council chamber, rest rooms, hall and clock tower | 18,300 k. w. |
| Public service and auditor's office | 2,173. k. w. |
| Total kilowatts used (all meter) | 20,473 k. w. |

*Street lighting*:

| | |
|---|---|
| 155 arc lamps and 34 series lamps (on meter) | 155,690 k. w. |
| 100 lamps in arches and alleys (estimated) | 23,060 k. w. |
| Total kilowatts used for street lighting | 249,750 k. w. |
| Total kilowatts used for all city lighting | 270,223 k. w. |

(The city used 17 per cent. of the total kilowatts generated.)

Cost of maintenance of street arc lamps for the year 1912, including labor of trimming, globes, carbon, lamp repair parts, etc., was $1,110.00.

*Bonds Outstanding of Electric Plant*:

$18,000@4½% interest, all due Jan. 1, 1918.
$28,000@4 % interest, first bond due Sept. 1, 1917.
$ 4,000@4 % interest, all due June 1, 1924.
$ 1,500@4 % interest, first bond due Sept. 1, 1925.

Total bonds outstanding, $51,500.
Amount of interest due each year, $2,150.

# A SUBMERGED SEWER OUTLET

The Sanitary District of Chicago completed and placed in operation the North Shore Channel in the spring of 1911. In the construction of this channel thru Evanston several sewers were cut in two, and at that time the Sanitary District established a rule to have all sewer outfalls submerged if possible. Four screw pumps, each with a capacity of 250 c.f.s., pump the water from the lake into the channel, the lift being 3 feet. If two pumps only are being used the water in the channel will be between 0 and plus 3, and as the number of pumps in use varies, the elevation in the channel varies accordingly.

In 1912 a small system of combined sewers was laid in the northwest section of Evanston to drain a district just north of the North Shore Channel. The outfall was designed to have all dry weather and most of the storm water flow submerged. The grade of the 20-inch tile sewer above the drop manhole is 32 per cent., giving a capacity flowing fall of 9.5 c.f.s., using 0.011 for $n$ in Kutter's formula. With the water in the channel at plus 3 the 12-inch submerged outfall has a capacity of 7.8 c.f.s., or the capacity of the 20-inch pipe flowing 0.7 full. In case of severe storms the upper 20-inch pipe will be required to take care of that part of the flow the 12-inch pipe cannot carry.

From experiments conducted with a weir in an old sewer, an automatic water level gage, and a tipping bucket rain gage, in the last half year it has been found that the peak of the run-off will not last over fifteen minutes in a sharp storm and not over thirty minutes in a very severe storm. With these data it is considered that the upper 20-inch outfall will seldom be brought into use and that time will be delayed until the district is well built up and paved so that the percentage of impervious territory will give a quick run-off in times of sharp storms.

The estimate for the outfall was $750 and was contracted for at that price. The contractor took advantage of times when all the pumps were shut down at the pumping station, and the water in the channel was at 0.0, to do most of his work. The pipes were surrounded with reinforced concrete as the banks of the canal have slipped in in a number of places along the canal, and it was feared that a slip might destroy the outfall. No difficulties were encountered in constructing the work and the contractor made a fair profit at the price bid.

# EDITORIAL

## WHAT IS A FAILURE IN MUNICIPAL OWNERSHIP?

A pamphlet was recently published by Public Service Publishing Company entitled "Two Hundred Municipal Ownership Failures," by Glenn Marston, which gives in the opening sentence of its introduction the difference between a municipal ownership failure and a business failure, both being on account of inability to meet expenses from the proceeds of operation of a public utility plant, the latter resulting in bankruptcy and the former in increased tax rate to meet the deficit. Financially, this may be correct, but practically, a municipally owned plant which does not pay its expenses may be a success from other points of view.

However, there would be no strong objection to this classification if it were adhered to, but the last sentence in the aforesaid introduction proposes to include in the list those municipal plants whose officials have failed to respond to requests for reports, on the ground that "it is a justifiable conclusion to believe that the plant is not sufficiently successful to make a report desirable." One might as well declare privately owned plants failures because they refuse to make reports.

Some such procedure was necessary to help round out the two hundred, but even counting Pittsburgh and Allegheny as the three entries made, the list is still not full.

But yet no serious complaint would be made of the list were it not filled with misinformation and misrepresentation, which is so flagrant that it need only be shown in enough cases to demonstrate its animus to destroy the entire effect of the publication. This is done elsewhere. Here it is only necessary to state briefly the nature of these misrepresentations by a few examples.

Towns absorbed by adjoining cities and therefore going out of business as separate corporations.

Investigations of other city departments in years past applied to new plants just starting.

Plants never owned by cities reported as sold by them.

Small generating plants discontinued because current can be purchased wholesale from larger plants for less money should be commended rather than listed as failures, as private plants would be.

Successful combined water and light plants are not municipal ownership failures because they do not keep the two accounts separate.

Controversies between "ins and outs" do not demonstrate failures of the plants when the figures show success.

Differences in bookkeeping methods have put several very successful Massachusetts plants into the list as well as some others, altho the books show the success, whatever system of keeping them is used.

Deficit the first year is hardly evidence of failure.

A failure of an automatic valve is hardly sufficient evidence of failure of municipal ownership. How many private plants are free from such failures? Or public plants?

The misrepresentations, or, to be as charitable as possible, the mistakes in getting information, are numerous and include such items as reporting city as closing power plant to purchase current of traction company when the reverse is the fact; reporting plants as burned, closed, leased to private parties, which events have not happened and plants are still in successful operation; increase in rates or high rates when decreases in rates and low rates are the real circumstances.

All these defects in the report and the list and many more have been demonstrated easily and are conclusive evidence of its utter unreliability. The fact that the author selected some of his information on the ground precludes the idea that all the misstatements are mistakes caused by ignorance of the true facts or dependence on rumors and reports from unauthorized sources.

Such publications by the advocates of private ownership are doubtless considered by their authors as dangerous attacks upon municipal ownership, but the shells are found to be empty and the firing of the gun is far more dangerous to the gunners than is the landing of the shot. Indeed, this shot is so badly timed that it exploded in air, and not even the bits of shell have landed.

The writer holds no brief for municipal ownership, but he does like to see good weapons used fairly, and will show up misrepresentation and falsehood when found in arguments on either side.

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## THE OUTLOOK FOR THE YEAR

The full reports of prospective work in the various lines of municipal improvement which appear in this number of MUNICIPAL ENGINEERING give evidence that the contractors for municipal work will be busy during 1913. Our American cities are rapidly passing their early periods of accumulation of wealth, when every effort is bent to the rapid growth of material projects. They are coming into the next period, when money is easier, when taxes are paid with less complaint or higher taxes are paid without more complaint, especially when good results are in evidence, when they show that the city is getting its money's worth.

# MEN PROMINENT IN MUNICIPAL AFFAIRS

## William W. Marr

Consulting engineer and member of firm of Aetna Engineering Bureau, Chicago, Ill., graduate Notre Dame University, 1896; entered the service of the city of Chicago in 1897 and acted in various capacities until 1903, when he became division engineer in charge of street pavements, which position he held until 1912, when he resigned to enter private practice.

As division engineer for the city of Chicago, Mr. Marr devoted considerable time to the study of street pavements and while acting as such made many improvements in methods of laying same. His most marked success was achieved while paving the "Loop," or business district of Chicago. Up to this time no satisfactory solution of paving along street car tracks had been brought to the attention of the municipal engineers in that city, with the result that no form of pavement had been made to stand up adjacent to street railway rails. After having been laid a short space of time, pavements showed signs of settlement. To correct these conditions, Mr. Marr investigated and found that previous to settlement sand appeared on the surface, showing that the sand cushion had moved from its original position; further investigation proved that the water from storms, sprinkling, etc., instead of draining into the catch basins, was remaining on the surface at the brow and gradually working its way beneath the paving blocks. This combined with street car traffic acted as a pump to force the sand from beneath one part of the pavement to another, the result being settlement along the car tracks. Having found the source of this trouble, Mr. Marr determined that the solution would be in perfect drainage between the car rail and the pavement. To secure this he arranged that the pavement should be laid not on a line level with the top of the rail nor above it, but on a line starting at the bottom of the bevel of the rail and dropping one inch or less within a space of twelve inches outside the rail, the result being a gradient sufficient to cause the water to drain. This system has been in use for the past three years and has today proven a success.

Member American Society of Civil Engineers and Illinois Society of Engineers and Surveyors.

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## C. D. Hill

Mr. C. D. Hill, engineer Board of Local Improvements, Chicago, Ill., graduate of University of Michigan, 1879, as civil engineer; 1879 to 1888, engaged on various engineering projects by the United States government and C. M. & St. P. R. R., the more important of which are the survey of the Hennepin Canal, the Chicago harbor, and railway construction in the west from 1882 to 1886.

In 1888, Mr. Hill entered the municipal field as assistant engineer, in charge of sewer and pavement construction for the village of Hyde Park, which later became part of Chicago. After annexation he was retained in the same position by the city of Chicago.

In 1893, Mr. Hill engaged in private practice and had charge of considerable work, being retained as a consulting engineer by many large contractors and corporations. In 1898, he became chief engineer of sewers of Chicago, and in 1901, this position was merged with the position of engineer of the Board of Local Improvements, which position he now holds.

As engineer of the board, Mr. Hill has been engaged during the past fifteen years in the designing and supervision of construction of sewers. The difficulties of this work are principally due to the limitations imposed by law, inasmuch as the cost of the work is assessed on property benefited and in no case can the assessment exceed the amount of the increase in the value of the land caused by the improvement. For that reason, it is not possible to build sewers in an outlying district that will be large enough when the district becomes densely populated.

In many portions of Chicago, where

Photo by Gibbon, Sykes & Fowler.

*Cicero D. Hill, Engineer of Local Improvements, Chicago, Ill.*

sewers were built twenty-five or more years ago, they are now inadequate and the conditions are rapidly becoming worse. In some of these districts, relief sewers have been built and in others plans are being prepared. It is difficult to show that all of the property which is served by the relief sewers is benefited, especially where cottages without basements have been built, and where the inadequacy of the sewers is apparent only in the deeper basements of the business houses, but the cottages may soon be replaced by the large, modern building, which could not be served properly by the existing sewers.

In the construction of these relief sewers, there are difficulties on account of the pavements to be replaced and because of interference with various underground pipe lines and conduits. These difficulties are met so far as is possible, by selecting streets where the pavements are worn out or by delaying the construction of the sewers, until the streets need to be repaved. Public utility corporations are required to care for and if necessary to remove their pipes and conduits, so that the property owners are put to no increased cost on that account.

The policy of building these sewers by special assessment has been quite satisfactory and the property owners are quite willing to pay their assesments after the sewer is built.

Since 1905, Mr. Hill has had charge of the design and construction of sewers as follows: 1905, 127,249 lin. ft. of sewers, ranging in diameter from 9 inches to 11 feet, constructed at a cost of approximately $595,000; 1906, 172,419 lin. ft. at a cost of approximately $842,000; 1907, 228,360 lin. ft. at a cost of $832,000; 1908,

Photo by Moffett, Chicago.

*Herbert E. Hudson, Division Engineer Board of Local Improvements.*

248,216 lin. ft. at a cost of $952,000; 1909, 292,239 lin. ft. at a cost of $1,090,000; 1910, 237,348 lin. ft. at a cost of $941,000; 1911, 259,556 lin. ft. at a cost of $545,000; 1912, 378,033 ft. at a cost of $683,000, not including sewers constructed by private contract.

Mr. Hill is a member of the American Society of Civil Engineers, Western Society of Engineers, Illinois Society of Engineers and Surveyors, Lake Michigan Water Commission and the Calumet Sewage Commission.

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## Herbert E. Hudson

In 1907, as a rodman, he was getting his experience in all branches of city work and laying a foundation for future work that would aptly fit him for the position he has now attained in the short space of four years.

By rapid rises, Mr. Hudson has, thru the civil service of Chicago, today reached the position of division engineer, with the improvement problems of large and exclusive residential suburban districts under his engineering guidance.

He attended Case School of Applied Science until 1907, when he entered the services of the city of Chicago as rodman. In 1908 he was promoted to the position of junior engineer of the Board of Local Improvements. In this capacity Mr. Hudson began to shoulder his greater responsibilities, principal of which was the construction of the intercepting sewers of the Lake View district in Belmont avenue and Wolfrom street. He was placed

Photo by Moffett, Chicago.

*William J. Galligan, Assistant Superintendent of Streets. Chicago. Ill.*

in charge of this work. It was of a highly exacting and difficult nature, requiring that all public service connections be maintained thruout the construction of the sewers.

He is at present in charge of the design and construction of the improvements carried on in the various north side suburbs, including Birchwood, Rogers Park, Edgewater, Jefferson, Ravenswood, Norwood Park, Edison Park, Forest Glen and Edgebrook, the population of which totals approximately 400,000.

During the year 1912, Mr. Hudson designed and supervised the construction of approximately twenty-six miles of brick and tile sewers, varying in diameter from twelve to seventy-two inches. He is a member of the Illinois Society of Engineers and Surveyors.

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## William J. Galligan

William J. Galligan, assistant superintendent of streets, Chicago, Ill., entered the municipal service in 1905, and promoted to his present position in 1912. Mr. Galligan, upon entering the service of the city was commissioned by the late Michael Dougherty, then superintendent of streets, to organize a bureau of compensation and to conduct it to the best interests of the city. That he was successful is shown by the collections turned in by this bureau, while in his charge. Among other innovations introduced by Mr. Galligan while here, were the first collections of compensation due the city for sub-sidewalk space overhanging bay windows, switch tracks on city property, streets, stub ends and various other special privileges for which the city received no compensation.

In October, 1906, Mr. Galligan was appointed superintendent of the Thirty-third ward and later assigned permanently to the Eighth ward, which is made up of the suburbs of South Chicago, the site of the Illinois Steel Company's south works, Hegewisch, the site of many manufacturing plants; Cheltenham, Windsor Park, Bryn Mawr and Park Manor, the last four being high-class residence districts along the south shore of Lake Michigan.

This district comprises approximately thirty-two square miles, with 250 miles of unpaved streets and a population of 63,000, made up principally of foreigners from southern Europe, who cannot understand the needs of cleanliness when applied to streets and alleys.

While acting as ward superintendent, Mr. Galligan introduced the system of whitewashing the alley fences and houses facing on alleys. This system is now practiced in all congested districts of Chicago, and has been taken up by other cities where conditions warrant the adoption of such measures.

As second superintendent of streets, Mr. Galligan has immediate charge of all street and alley cleaning, collection of garbage and refuse, and supervision over the ward superintendents and their forces in this branch of the service.

Owing to the numerous perplexing situations connected with the cleaning of the second largest city in the United States and perhaps one of the largest in the world, when the area is considered, one can readily surmise the extent of his responsibility.

Specific duties assigned to the position are as follows: Inspection of the condition of each ward, at least once every ten days; investigation of methods, machinery, etc., in use in other cities and reports as to the advisability of their adoption in Chicago; preparation of specifications, recommendations as to contemplated purchases of machinery, tools, materials, etc., used on the work under his supervision and reports at stated intervals, proposed means of procuring greater efficiency or reducing cost of the work.

# Municipal Improvements for 1913.

## What the Cities of the United States Expect to Construct during 1913.

*Cities whose programs of improvement have not yet been adopted and those not now contemplating improvements in 1913 are omitted.*

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## PAVEMENTS TO BE CONSTRUCTED IN 1913.

### ALABAMA.

**Dothan:** Indefinite.
**Gadsden:** Asphalt concrete, 20,000 sq. yds.
Macadam, 40,000 sq. yds.; city does this.

### ARIZONA.

**Phoenix:** $300,000 to be expended.

### ARKANSAS.

**Paragould:** Concrete, 45,000 sq. yds.

### CALIFORNIA.

**Alhambra:** Bituminous macadam, 2 miles.
**Burlingame:** $200,000 worth now in progress.
**Coalinga:** More than $125,000 expenditure probable.
**Colton:** Asphalt, 140,000 sq. ft.
**Fresno:** $100,000 to be expended.
**Gilroy:** Asphalt, 4,179 linear ft.
**Glendale:** $250,000 worth in progress.
**Huntington Beach:** Bituminous macadam, 2 miles 20 ft. wide.
Oiled surface, 1 mile 20 ft. wide.
Petrolithic, half mile.
**Imperial:** Concrete, 44,420 sq. yds.
**Inglewood:** Oil macadam, 170,250 sq. yds.
**Lodi:** Asphalt, 132000 sq. yds.
Concrete, 132,000 sq. yds.
**Long Beach:** Concrete, several miles.
**Los Angeles:** Asphalt, 25 miles.
Bituminous macadam, 5 miles.
Brick, 2 miles.
Concrete alleys, 1 mile.
**Monterey:** In contemplation for early work.
**Oakland:** Permanent pavement, 5 miles.
Oil macadam (including grading and curbing), 19 miles.
**Oroville:** Bitulithic, 9,900 ft., 42 ft. wide.
**Palo Alto** : Asphalt, 10,000 sq. yds.
**Pasadena:** Asphalt, 37,760 sq. yds.
Bituminous macadam, 1.44 mi.
Brick, 1,650 sq. yds.
Oiling, 5 mi. of 1 in. and 2 in.
Asphalt concrete, 3.5 mi.
**San Bernardino:** $150,000 to be expended.
**Santa Barbara:** Roads, $29,000.
**Sonoma:** Several blocks probable.
**Vallejo:** Bitulithic, 50,000 sq. yds.
Bituminous macadam, 50,000 sq. yds.
**Visalia:** $50,000 to be expended.
**Willits:** Asphalt, 21,000 sq. yds.
Concrete, 2,000 ft.

### COLORADO.

**Fort Collins:** $6,300 to be expended.
**Grand Junction:** $50,000 to be expended.

### CONNECTICUT.

**Ansonia:** Bituminous macadam, 1,500 sq. yds.
Granite, 5,000 sq. yds.
Wood, 3,500 sq. yds.
**Derby:** 4,000 sq. yds.
**Hartford:** 50,000 sq. yds.
**Middletown:** Bitulithic, 28,000 sq. yds. soon. Macadam, to be done only by city.
**Southington:** Work for this year not planned; large amount done last year.
**Torrington:** Bituminous macadam, 4,000 ft.
Macadam, 2,000 ft.
Other pavement, 1,000 ft.
**Wallingford:** Bithulithic, 8,500 sq. yds.
Bituminous macadam, 5,000 sq. yds.
Brick, 8,500 sq. yds.
Wood, 4,250 sq. yds.
Hassam or Warrenite, 8,000 sq. yds.

### DISTRICT OF COLUMBIA.

**Washington:** Asphalt and bituminous macadam.
Resurfacing, $365,000.
New work, $200,000.

### FLORIDA.

**Dade City:** Macadam, 6 miles.
**Sarasota:** $45,000 proposed.

### GEORGIA.

**Americus:** 2,000 sq. yds.
**Athens:** An election will be held on March 25 to issue $75,000 bonds for street improvements.
**Augusta:** Plans not completed.
**LaGrange:** Brick, 2,000 sq. yds.

### IDAHO.

**Boise City:** $150,000 to be expended.
**Weiser:** Bitulithic, 30536 sq. yds.

### ILLINOIS.

**Alton:** Brick, 3 miles.
**Assumption:** Brick, 6,500 sq. yds. let; 15,000 sq. yds. not let.
**Bloomington:** Brick, 57,514 sq. yds.
**Canton:** Brick, 35 miles.
**Carlinville:** Concrete, 5,000 sq. yds.
**Chicago Heights:** Bituminous macadam, 10,000 sq. yds.
Brick, 50,000 sq. yds.
**DeKalb:** Brick; will make plans, etc., for four streets to go in in 1913 or 1914.
**Dixon:** Asphalt, 7,400 sq. yds. contemplated, not decided.
Brick, 100,000 sq. yds.
Concrete, 2,400 sq. yds. contemplated and probable.
Macadam, 26,000 sq. yds.
**East St. Louis:** Brick, 240,110 sq. yds.
**Edwardsville:** Brick, 2,000 yds.
Concrete, 1,200 yds.
**Elgin:** Bituminous macadam, 50,000 sq. yds.
Brick, 34,373 sq. yds.
Asphaltic concrete, 11,355 sq. yds.
**Galesburg:** Brick, 66,861 sq. yds.
**Granite City:** Wood, 12,000 sq. yds.
**Greenville:** $10,000 estimated.
**Lake Forest:** Bituminous macadam, about 30,000 sq. yds. proposed.
**Mattoon:** Brick, 40,000 sq. yds.
**Maywood:** Brick, about 50,000 sq. yds.

**Moline:** Brick, 50,000 sq. yds.
Concrete, 20,000 sq. yds.
Wood, 30,000 sq. yds.
**Newton:** Concrete, 6,980 sq. yds.
**Normal:** Brick, 20,000 sq. yds.
**Oak Park:** Asphalt, 2.60 miles or 64,800 sq. yds.
Bituminous macadam, 8.90 miles, or 161,600 sq. yds.
Brick, 3 miles, or 34,000 sq. yds.
**Olney:** Brick; can not tell yet.
Macadam; not fully settled yet.
**Ottawa:** Brick, 66,000 and 123,000 sq. yds.
**Pekin:** Brick, 41,000 sq. yds.
**Pontiac:** Brick, 10,000 sq. yds.
**Quincy:** Bituminous macadam, 30,368 sq. yds.
Brick, 13,297 sq. yds.
Creosoted wood, 15,741 sq. yds.
**Rockford:** Brick, 50,000 sq. yds.
Macadam, 15,000 sq. yds.
**Rock Island:** $200,000 will be expended.
**Streator:** Brick, 9,000 sq. yds.
**Waukegan:** Brick, 29,000 sq. yds.
Wood, creosote, 3,500 sq. yds.
Cedar blocks, 900 sq. yds.
Asphaltic concrete, 8,600 sq. yds.
Sandstone blocks, 1,850 sq. yds.
**Wood River:** Bituminous macadam, 15,000 sq. yds.

### INDIANA.

**Bloomington:** Brick, 25,000 sq. yds.
Macadam, 5,000 sq. yds.
**Connersville:** Concrete, 35,000 sq. yds. by city, 6,000 sq. yds. by county.
Macadam, 2¼ mi. stone, 14 to 20 ft. wide; 3½ mi. gravel, 14 ft. wide; by county.
**Covington:** Macadam, 9,000 sq. yds.
**Crawfordsville:** Brick, 42,485 sq. yds.
Concrete, 7,940 sq. yds.
**Fort Wayne:** Asphalt, 3.5 miles.
Bituminous macadam, 0.5 miles.
Brick, 3.0 miles.
**Gary:** Bituminous macadam, 9,000 sq. miles.
Brick, 30,000 sq. yds.
Macadam, 62,000 sq. yds.
**Hartford City:** Brick, 30,000 yds.
Concrete, 30,000 yds.
**Huntington:** No prospects for pavement this year.
**Lafayette:** Brick, 379 sq. yds. alley paving.
**North Vernon:** Brick, 3,000 yards.
Macadam, some.
**Plymouth:** $30,000.
**Portland:** 15,000 sq. yds.
**Richmond:** Brick, 16,200 sq. yds.
Concrete, 3,000 sq. yds.
Macadam, 4,000 sq. yds.
Gravel, 2,000 sq. yds.
**Terre Haute:** 47,757.67 sq. yds.
**Burlington:** Brick, 1,500 sq. yds.
Concrete, 32,500 sq. yds.
**Cedar Falls:** Not known until May.
**Cedar Rapids:** Asphalt to resurface, 50,000 yds. (now let).
Brick, 4-inch concrete base, 45,000 yds.
Concrete, 6,500 yds.
**Clinton:** Brick, 100,000 sq. yds.
Concrete, 28,000 sq. yds.
**Corning:** Brick, 24,000 yds.
Concrete, 1,000 yds.
**Dubuque:** Bituminous macadam, 10,000 sq. yds.
Brick, 30,000 sq. yds.
Macadam, 30,000 sq. yds.
Wood, 30,000 sq. yds.
**Eagle Grove:** Asphalt, bitulithic or bituminous macadam, 30,000 sq. yds.
**Fort Madison:** Brick, 22,500 sq. yds.
**Hamburg:** Bituminous concrete, 30,000 sq. yds.
**Independence:** Asphalt concrete, 14 blocks.
**Indianola:** $12,000.
**Marion:** (Complete change of officers last Monday in March; nothing doing now.)
**Marshalltown:** $48,000 worth.
**Muscatine:** $25,000 worth.
**Newton:** Concrete, 55,000 yds.
**Oskaloosa:** Brick, possibly 10 to 20 blocks.
**Red Oak,** (Will have new council last of March and nothing doing now.)
**Webster City:** Either asphalt, bitulithic or bituminous, 20,000 sq. yds.

### KANSAS.

**Arkansas City:** Asphalt, 12 blocks; bids open March 3.
Bituminous macadam, 12 blocks.
**Chanute:** Brick or concrete, 6,000 sq. yds.
**El Dorado:** Brick; not certain, but possibly 6,000 yds.
**Emporia:** Bituminous concrete or brick, 20,000 sq. yds. or more. (Contract in March.)
**Fort Scott:** $20,000 worth.
**Girard:** Asphalt, 1,400 sq. yds.
Brick, 300 sq. yds.
**Manhattan:** 30,000 sq. yds.
**McPherson:** Brick or asphaltic concrete, about 25,000 sq. yds.
**Newton:** Either bitulithic or brick, 50,000 sq. yds.
**Osawatomie:** Will spend about $20,000.
**Ottawa:** Bituminous macadam, 6,500 sq. yds.
Brick, 5,000 sq. yds.
**Paola:** Brick, 7,000 yds.
Concrete, 3,000 yds.
**Pittsburg:** Brick, 60,000 sq. yds.
Concrete (under consideration).
**Salina:** Asphalt, one-half mile.
Brick, one-half mile.
**Topeka:** Prospects for $100,000 expenditure.
**Wichita:** Asphalt, ½ mile.
Bituminous macadam, 1½ miles.
Brick, 1 mile.
Concrete, ¼ mile.

### KENTUCKY.

**Dayton:** $30,000 worth.
**Louisville:** Will spend $750,000 in new pavements, lettings in March and April.
**Ludlow:** $20,000 worth.
**Owensboro:** 7,000 sq. yds.
**Pikeville:** Brick, 27,000 sq. yds.

### LOUISIANA.

**Baton Rouge:** Are talking of issuing bonds for gravel roads, etc., but nothing definite.
**New Orleans:** Asphalt, 63,400 sq. yds.
Bitulithic, 5,500 sq. yds.
Mineral rubber, 19,500 sq. yds.
Creosoted wood block, 3,200 sq. yds.
Granite, 700 sq. yds.

### MAINE.

**Lewiston:** Bituminous macadam, about 5,000 sq. yds.
**Pittsfield:** 5,000 sq. yds.
**Rockland:** Bituminous macadam, 5,000 sq. yds.

### MARYLAND.

**Baltimore:** Will spend $1,000,000 to $1,500,000.

### MASSACHUSETTS.

**Cambridge:** (Plans and estimates not yet made.)
**Fitchburg:** Macadam, 20,000 sq. yds.
One mile of street construction.
**Great Barrington:** (Not yet determined.)
**Lawrence:** Granite, 20,750 sq. yds.
**Lowell:** $75,000 worth.
**Medford:** (Not determined; use no contract labor.)
**New Bedford:** Nothing definite decided upon.
**Southbridge:** Either bitulithic or bituminous macadam, 15,000 sq. yds.

Brick, 8,700 sq. yds.
Drainage and subgrade, 3 miles long.
**Webster:** (Not yet determined.)
**Westfield:** Asphalt, 20,000 sq. yds.
Macadam, 25,000 sq. yds.

### MICHIGAN.

**Alpena:** Concrete, about 10,000 sq. yds. (nothing definite until May 1).
**Cadillac:** 8,000 sq. yds.
**Escanaba:** 14,000 sq. yds.

**Detroit:**

| | |
|---|---|
| Resurfacing 24 streets with brick | $295,800.00 |
| Patching brick pavements. | 60,000.00 |
| Patching and repairing cedar block pavements.. | 50,000.00 |
| Resurfacing 12 streets with granite block | 273,660.00 |
| Patching granite block pavements | 5,000.00 |
| Stone pavements and alley crossings | 15,000.00 |
| Foundations of 21 streets under tracks | 387,050.00 |
| Resurfacing and repairing pavements under and along tracks, Detroit Ry. | 25,000.00 |
| Repaving, dressing stone and other expenses | 7,000.00 |
| Repaving 9 streets with asphalt | 90,220.00 |
| Repaving 6 streets with brick | 32,030.00 |
| Repaving 2 streets with creosoted block | 17,910.00 |
| Resurfacing 35 streets with creosoted block | 929,500.00 |
| Patching creosoted block pavements | 500.00 |
| Resurfacing 39 street with asphalt, brick, cedar, creosote block, granite block and stone pavements, and estimate for asphalt is | 406,122.00 |
| For patching sheet asphalt pavements | 25,000.00 |
| Total | $2,619,792.00 |

**Grand Rapids:** $100,000 to $200,000 will be spent.
**Greenville:** (Nothing in sight.)
**Hastings:** Concrete, 16 blocks, 28-foot roadway; letting of contract, March 28.
**Highland Park:** 35,000 to 50,000 sq. yds.; material determined when contracts let.
**Hillsdale:** Asphaltic concrete, 20,000 sq. yds.
Brick, 6,000 sq. yds.
Macadam, 12,000 sq. yds.
**Port Huron:** Bituminous macadam, 15,000 sq. yds.; resurfacing.
**Saginaw:** Asphalt, 30,000 yds.
Brick, in gutters only.
Macadam, 5,000 yds.

### MINNESOTA.

**Bemidji:** 7,000 sq. yds.
**Faribault:** Wood, 11,600.
**Mankato:** Bituminous macadam, 1 mile.
Gravel, ½ mile.
**Minneapolis:** Bituminous macadam, 50,000 sq yds.
Brick, 20,000 sq. yds.
Concrete, 20,000 sq. yds.
Wood creosoted, 150,000 sq. yds.
Sandstone, 10,000 sq. yds.
**St. Paul:** New pavements, $800,000.
**Stillwater:** Brick, possibly 2 blocks.
Concrete, possibly 5 blocks.
Macadam, few blocks possible.
**Winona:** Brick, 4,970.
Wood, 12,500.

### MISSISSIPPI.

**Clarksdale:** Either asphalt, bitulithic, brick, concrete or wood, 15,000 sq. yds.
**Hattiesburg:** Brick, 1,000 sq. yds.
Macadam, 5 miles to be built by county within city limits.
**Vicksburg:** 8,200 feet.

### MISSOURI.

**Columbia:** Concrete, 17,883 sq. yds.
**Fulton:** Brick, 1,500 sq. yds.; contract let
Concrete, 3,400 sq. yds.
**Hannibal:** Bitulithic, 40,000 sq. yds.
Bituminous macadam, 25,000 sq. yds.
Brick, 16,000 sq. yds.
Concrete, 30,000 sq. yds.
**Independence:** Work will not be outlined until after April 15.
**Jefferson City:** Bituminous macadam (penetration), 3 miles.
Brick, 0.2 miles.
**Kansas City:** Asphalt, 130,000 sq. yds.
Bituminous macadam, 15,000 sq. yds.
Brick, 75,000 sq. yds.
Concrete, 200,000 sq. yds.
Stone block, 25,000 sq. yds.
Wood, 10,000 sq. yds.
**Kirksville:** Asphalt, 15,000 sq. yds.
Brick, 6,000 sq. yds.
Concrete, 12,000 sq. yds.
Other pavements, 5,400 sq. yds.
**Liberty:** Concrete, 40,000 sq. yds.
**Nevada:** Concrete, 10,000 sq. yds.
**Poplar Bluff:** Brick, 2 miles.
**Sedalia:** Bituminous macadam, 10,000 sq. yds. contemplated.
Brick, 30,000 sq. yds.
Concrete, 5,000 sq. yds. contemplated.
**Springfield:** Asphalt, 50,000 sq. yds.
Concrete, 100,000 sq. yds.
Wood, 2,040 sq. yds.
**Webb City,** Bituminous macadam, 1 mile.

### MONTANA.

**Bozeman:** Will spend $100,000.
**Great Falls:** Bitulithic, 50,000 sq. yds.
**Helena:** Brick, 15,000 sq. yds.
Macadam, 10,000 sq. yds.
**Lewistown:** (List will not be completed before March 1.)

### NEBRASKA.

**Falls City:** Brick, 25,000 sq. yds.
**Lincoln:** Asphalt, about 45,000 sq. yds.
Brick, about 45,000 sq. yds.
**Norfolk:** Bituminous Concrete, 45,000 sq. yds.
Macadam, 5,000 sq. yds.
**University Place:** Brick, 8 blocks.

### NEVADA.

**Reno:** Bituminous macadam, 2 miles.

### NEW HAMPSHIRE.

**Laconia:** $10,000 worth.
**Littleton:** Macadam, 2,600 feet in length.

### NEW JERSEY.

**Bayonne:** $175,000 worth in contemplation.
**Dover:** Macadam and grading by town.
**Elizabeth:** Five miles.
**Jersey City:** Asphalt street repair, $12,500.
Macadam maintenance, $10,000.
**Long Branch:** Bitulithic, 68,000 sq. yds.
Brick, 60,000 sq, yds.
**Newark:** Asphalt, 1 mile, or 21,000 sq. yds.
Bitulithic, 1½ miles, or 32,000 sq. yds.
Brick, 2 miles, or 45,000 sq. yds.
Granite, 6 miles, or 127,000 sq. yds.
Asphalt blocks, 1 mile, or 21,000 sq. yds.
**Ocean City:** Brick, 5,000 sq. yds.
Concrete, 10,000 sq. yds.
Wood, 10,000 sq. yds.
Gravel, 10,000 sq. yds.
**Plainfield:** Bituminous macadam, possibly small amount.

Brick, possibly small amount.
Concrete, possibly small amount.
Macadam, 2 miles.
Wood, some street railway intersections.

**Ridgewood:** Brick, 3,300 sq. yds.
Macadam, 29,000 sq. yds.

**Rutherford, Boro. of:** Brick, 1.25 miles, 32,000 sq. yds.
Macadam, 1 mile.
Tarvia, 1 mile.

**South Orange:** Bituminous macadam, 2 miles.
Macadam, 3 miles.

**Trenton:** Asphalt, 10,000 sq. yds.
Bituminous concrete, 70,000 sq. yds., "Topeka Spec."
Brick, 8,700 sq. yds.
Concrete, 5,700 sq. yds.
Granite, 2,000 (with old blocks).

**Westfield:** Concrete, 20,000 sq. yds.
Macadam, 25,000 sq. yds.

**West New York:** Asphalt block, 8,000 sq. yds.
Bitulithic, 6,000 sq. yds.
Brick, 8,000 sq. yds.
Trap rock blocks, 12,000 sq. yds.

### NEW MEXICO.

**Albuquerque:** Expects to contract about $75,000 of pavements.

### NEW YORK.

**Binghamton:** Bitulithic, 12,000 sq. yds.
Brick, 9,000 sq. yds.
Concrete, 7,000 sq. yds.

**Carthage:** $18,000.

**Catskill:** From 1,300 to 1,400 feet of the State Highway, which passes through Catskill, may possibly be paved.

**Cortland:** Bituminous macadam, 1,400x20 ft.; 1,500x60 ft.
Concrete, 1,400x9 ft.

**Elmira:** Asphalt, 2,000 sq. yds.
Brick, 28,000 sq. yds.

**Hudson:** $35,000.

**Ilion:** Bitulithic, 25,000 sq. yds.

**Jamestown:** Three miles.

**Manhattan, Boro of, New York City:** (Queston of improvements not yet settled).

**Niagara Falls:** About 60,000 sq. yds. (material decided after bids are received.)

**Norwich:** None.

**Ogdensburg:** Brick paving, 63,500 sq. yds. contract let.

**Rensselaer:** Brick, 1½ miles.
Macadam, ½ mile.

**Rye:** Asphalt block, 4,750 sq. yds.
Bituminous macadam, 56,000 sq. yds.

**Schenectady:** Asphalt, 80,000 sq. yds.
Bituminous macadam, 4,000 sq. yds.
Brick, 6,000 sq. yds.

**Syracuse:** Asphalt, 3 miles.
Brick, 2.13 miles.
Macadam, 1.12 miles.

**Troy:** Asphalt, 10,000 to 60,000; type not decided upon.
Bitulithic, 60,000; type not decided upon.
Bituminous macadam, 27,000.
Brick, 35,000.
Concrete, 60,000; type not decided upon.
Granite relaid, 100,000.

**Watertown:** Bitulithic, 1 mile.
Bituminous macadam, 1 mile.
Brick, 1 mile.
Concrete, ½ mile.
Macadam, 2 miles.
Wood, 1-3 mile; contract let.

### NORTH CAROLINA.

**Greensboro:** Bituminous macadam, 2,000 ft.
Concrete dolarway, 4,000 ft.

**Lumberton:** Bituminous macadam, 10,000 sq. yds.

**Raleigh:** Will vote in early spring on $500,000 bond issue for street paving.

**Rocky Mount:** About $50,000 estimated; kind not decided.

**Wilmington:** Clay gravel, 8,000 sq. yds.

**Wilson:** $80,000.

### NORTH DAKOTA.

**Minot:** Will receive bids on 19,232 sq. yds. of bitulithic, brick, concrete, creosoted block and sandstone; kind to be determined at time of letting.

### OHIO.

**Barberton:** Brick, 10,963 sq. yds.

**Bowling Green:** Bituminous macadam, 2,500 sq. yds.

**Bryan:** Contract let for 25,200 sq. yds. paving with Metropolitan block, 6-inch concrete foundation, cement curb and gutter.

**Cambridge:** Brick, 22,500 sq. yds. on 4-inch concrete base.

**Canton:** Brick, 6 miles.

**Carrollton:** Brick, 1,500 sq. yds.

**Conneaut:** Brick, 2,200 lineal ft.

**Delaware:** 18,000 sq. yds.

**Fostoria:** Asphalt block or brick, 33,000 sq. yds.

**Lorain:** 40,000 sq. yds. paving; bids to be asked for on asphalt, bitulithic, bituminous macadam and brick.

**Mansfield:** $66,000.

**Massillon:** Brick, 28,000 sq. yds.
Concrete, 900 sq. yds.
Macadam, 20,000 sq. yds.
Gravel, 15,000 sq. yds.
Bituminous macadam, probably.

**Miamisburg:** 15,000 sq. yds.

**Newark:** Brick, 51,961 sq. yds.

**Niles:** Brick, 50,000 sq. yds.

**Paulding:** Brick, 2,500 sq. yds.

**Pomeroy:** Brick or concrete, 22000 sq. yds.
County is planning to build about five miles of brick road or concrete road with asphalt wearing surface.

**Ravenna:** Brick, 10,210 sq. yds.

**Salem:** Brick, 358 ft., 16 ft. alley.

**Springfield:** 205,460 sq. yds.; specifications open to asphalt, bitulithic, brick and wood.

**Steubenville:** Brick, 40,000 sq. yds.

**Tiffin:** Brick, 14,800 sq. yds.
Concrete, 2,615 sq. yds.
Macadam, 1 mile long, 14 ft. wide.
The brick paving is to have sandstone curb, and the concrete paving to have concrete curb.

**Warren:** $60,000.

**Wellsville:** Brick, 10,000 sq. yds.

**Wooster:** Brick, 39,665 sq. yds.

**Zanesville:** Brick, 72,000 sq. yds.

### OKLAHOMA.

**Durant:** $75,000.

**McAlester:** Concrete, 800 ft.

**Okmulgee:** Will probably spend about $100,000.

**Tulsa:** Five miles.

### OREGON.

**Coquille:** Bituminous macadam, 13,000 sq. yds.
Concrete, 4,000 sq. yds.
Wood, 2,200 sq. yds.

**Eugene:** Asphalt and bitulithic or bituminous macadam, 101,500 sq. yds.; probably about half of each.
Bitucrete, 3,500 sq. yds.
Macadam, 4,000 lin. ft.

**Grant's Pass:** 35,000 sq. yds.

**McMinnsville:** 3 to 4 miles.

### PENNSYLVANIA.

**Athens:** Macadam, about 1,200 ft.

**Catasauqua:** Bituminous macadam, 8,000 sq. yds.

**Dravosburg:** Brick, 10,000 sq yds.

**DuBois:** Brick, 8,000 sq. yds.

**Erie:** Asphalt, 7,500 ft., 86,500 yds.
Brick, 3,000 ft., 10,000 yds.

**Farrell:** Brick, 30,000 sq. yds.
**Franklin:** 15,000 sq. yds.
**Hanover:** Asphalt, brick or wood, about 48,000 sq. yds.; material not determined; will ask for bids on each kind.
**Harrisburg:** Asphalt, 66,624 sq. yds.
**Hollidaysburg:** 8,000 sq. yds.
**McKeesport:** $52,000.
**McKees' Rocks:** Brick, 6,000 sq. yds.
Granite, 6,000 sq. yds.
**Meadville:** One mile.
**Monongahela:** Brick, 7,600 sq. yds.
**New Brighton:** Brick, 8,000 sq. yds.
**Norristown:** $13,000 worth.
**Ridgway:** Brick, 11,000 sq. yds.
**Sayre:** Brick, 1,200 ft. or 4,800 sq. yds.
**Sharpsville:** Brick, 10,000 sq. yds.
**Swissvale:** Brick, 1.4 miles, 23,000 sq. yds.
**Wilkesbarre:** Contemplates expenditure of $75,000.
**York:** Asphalt, bitulithic or brick, 20 miles.

### RHODE ISLAND.

**Cranston:** $40,000.
**East Providence:** Bituminous macadam, 4,400 linear feet.
Macadam, only considerable resurfacing.
**Newport:** (Appropriations not yet made.)
**Pawtucket:** (No work yet outlined.)
**Woonsocket:** Granite, 3,500 sq. yds.

### SOUTH CAROLINA.

**Charleston:** $90,000 of street work proposed.
**Columbia:** Asphalt, contract awarded for 4,500 ft. of 50-foot street.
Brick, 1,500 ft. of 40-foot street.

### SOUTH DAKOTA.

**Aberdeen:** One mile.
**Sioux Falls:** Concrete, 40,000 yds.

### TENNESSEE.

**Columbia:** Macadam, 29,000 sq. yds.
**Memphis:** Asphalt, 50,000 sq. yds.
Bituminous macadam, 10,000 sq. yds.
Brick, 5,000 sq. yds.
Concrete, 2,000 sq. yds.
Wood, 40,000 sq. yds.
Gravel, 10,000 sq. yds.

### TEXAS.

**Brownsville:** One mile.
**El Paso:** Will spend $250,000 or more on pavements.
**Lufkin:** (Some talk of street improvements and public roads, but nothing definite.)
**Paris:** Asphalt, 40,000 sq. yds.
Brick, 4,000 sq. yds.
Macadam, 7,000 sq. yds.
**Waxahachie:** Brick, 1 mile.
Macadam, 1½ miles.
Wood, 8,000 sq. yds.
Hassam, 6,000 sq. yds.

### UTAH.

**Ogden:** Asphalt, 22,106 sq. yds.
Concrete, 1,700 ft. 20 ft. wide.
**Salt Lake City:** Asphalt, 5.8 miles.
Concrete, 0.3 miles.

### VERMONT.

**Barre:** Granite, 7,000 sq. yds.
**Bellows Falls:** Macadam, ½ mile.

### VIRGINIA.

**Newport News:** Bituminous macadam, 10,000 sq. yds.
Brick, only repairs.
Broken stone and gravel, 7,000 sq. yds.

### WASHINGTON.

**Aberdeen:** Asphalt, 70,000 sq yds.
Concrete, 3,500 sq. yds.
Wood, 2 mi., 16 or 20 ft. wide.
**Hoquiam:** Asphaltic concrete, 35,000 sq. yds.
Bitulithic, 15,000 sq. yds.
Above in prospect. Contracts already awarded for equal amount.
**Pullman:** Asphalt, bitulithic and bituminous macadam, 17,000.
Oiled macadam, possible trial.
**Seattle:** Asphalt paving, 150,000 sq. yds.
Brick, 75,000 sq. yds.
Sandstone, 16,500 sq. yds.
Wood, 7,500,000 ft. B. M.
**Tacoma:** Pavements, $400,000.
**Walla Walla:** About 30,000 sq. yds., kind not yet determined.

### WEST VIRGINIA.

**Parkersburg:** Brick, 90,000 sq. yds.
Concrete, 40,000 sq. yds.

### WISCONSIN.

**Baraboo:** One mile.
**Baraboo:** One miles.
**Burlington:** Macadam, 10,000 sq. yds.
**Chippewa Falls:** $10,000.
**Delavan:** Brick, 8,912 sq. yds.
**Eau Claire:** Bituminous macadam, 3,000 sq. yds.
Brick, 1,000 sq. yds.
Macadam, considerable; no exact figures.
Wood, 2,000 sq. yds. on bridge.
**Fort Atkinson:** Two miles.
**Kenosha:** 15 miles.
**Madison:** Bituminous macadam, 85,000 sq. yds.
**Marinette:** Macadam, 20,000 sq. yds.
**Oshkosh:** Sarco, 4,300 sq. yds.
Tar macadam, 7,260 sq. yds.
Brick, 2,100 cement filler.
Concrete, 30,000 reinforced.
Macadam, 4,000 sq. yds.
$21,000 appropriated for improvement of streets by paving or otherwise; also $3,000 for crushed stone and gravel for repairs of streets.
**Portage:** Bituminous macadam, 30,000 sq. yds.
**Port Washington:** 22,000 sq. yds.; material not determined.
**Sheboygan:** Brick, 23,900 sq. yds.
Concrete, 46,820 sq. yds.
Macadam, 9,000 sq. yds.
Wood, 1,550 sq. yds.
Other, 12,400 sq. yds.
**South Milwaukee:** Concrete, 15,000 sq. yds.
**Two Rivers:** $22,000.
**Waukesha:** Bituminous macadam, 40,000 sq. yds.
**Waupaca:** Concrete, 1,000 sq. yds.
Macadam, 6,400 sq. yds.

### CANADA.

**Chatham, Ontario:** Bitulithic, 2,800 yds.
**Guelph, Ontario:** Concrete, 9,000 sq. yds.
Tar macadam on concrete base, 13,890
**Hamilton, Ontario:** Asphalt, 75,000 sq. yds.
Bituminous macadam, 20,000 sq. yds.
Concrete, 3,000 sq. yds.
Macadam, 85,000 sq. yds.
Wood, 12,000 sq. yds.
**Lethbridge, Alberta:** Asphalt and bitulithic, 14,000 sq. yds.
**London, Ontario:** Asphalt, 3,000 ft.
Bitulithic, 3,500 ft.
Brick, 2,000 ft.
Concrete, 5,300 ft.
**Ottawa, Ontario:** Asphalt, 4 miles.
**Prince Rupert, B. C.:** Plank roads, $45,000.
**Regina, Sask.:** Wood, asphalt and bitulithic; total, 170,000 sq. yds..
**Vancouver, B. C.:** Not yet outlined.

### NOVA SCOTIA.

**Halifax:** Bituminous macadam, 5,000 yds.
Macadam, 10,000 yds.

# SIDEWALKS TO BE CONSTRUCTED IN 1913

### ALABAMA.

**Dothan:** Indefinite.
**Gadsden:** Cement, 2 miles.
**Jasper:** Cement, 1 mile.

### ARIZONA.

**Nogales:** A little.
**Phoenix:** 25 miles.

### ARKANSAS.

**Paragould:** Cement, 1,000 sq. yds.

### CALIFORNIA.

**Alhambra:** Cement, 1 mile.
**Azuza:** Considerable contemplated.
**Burlingame:** $75,000 worth now in progress.
**Fresno:** $10,000.
**Huntington Beach:** Cement, about ½ mile.
**Imperial:** Cement, 14 miles, 4 feet wide.
**Inglewood:** Cement, 155,000 sq. ft.
**Lodi:** Cement, 7,000 lin. ft.
**Los Angeles:** Cement, 75 miles.
**Oakland:** Cement, 31 miles.
**Oroville:** Cement, 1 mile, 5 feet wide.
**Palo Alto:** Cement, 6,000 ft.
**Pasadena:** Cement, 6,000 ft.
**San Bernardino:** 4 miles.
**Sonoma:** Several blocks probable.
**Vallejo:** Cement, 30,000 sq. yds.
**Visalia:** 2 miles.

### COLORADO.

**Ft. Collins:** $4,000.
**Grand Junction:** 2 miles.

### CONNECTICUT.

**Ansonia:** 3,000 ft.; material not designated.
**Derby:** ½ mile.
**Middletown:** This is done in small individual lots by local contractors.
**Southington:** Cement, 25,000 sq. ft.
**Torrington:** Cement,, 5,000 lin. ft.
Tar, 3,000 lin. ft.
**Wallingford:** Cement, 1,000 ft. 7.5-ft. walk.

### DISTRICT OF COLUMBIA.

**Washington:** Sidewalks, cement, $220,000.
Alleys, brick and asphalt block.

### FLORIDA.

**Dade City:** Cement, 2,000 sq. yds.

### GEORGIA.

**Americus:** 3 miles.
**La Grange:** Cement, 1 mile of 6-ft. walks.

### IDAHO.

**Boise City:** 18 miles.
**Weiser:** Cement, 64,000 sq. yds.

### ILLINOIS.

**Alton:** Cement, 1 mile.
**Bloomington:** Cement, 15 miles.
**Canton:** Brick, 1 mile.
Cement, 5 miles.
**Carlinville:** Cement, 20,000 sq. ft.
**Centralia:** Cement, 20,000 lin. ft.
Stone, 100,000 sq. ft.
**Chicago Heights:** Cement, 10,000 lin. ft.
**Dixon:** Cement, 5,000 sq. ft.
**East St. Louis:** 40 miles.
**Edwardsville:** Cement, 150,000 sq. ft.
**Elgin:** Cement, 10 miles.
**Granite City:** Cement, 38,000 sq. ft.
**Lake Forest:** Cement, probably 3,000 lin. ft. 5-ft. walk.
**Mattoon:** Cement, 10,000 sq. ft.
**Moline:** Cement, 8 miles.
**Normal:** Cement, 24,000 sq. ft.
**Oak Park:** 9 miles.
**Olney:** Cement; amount not decided.
**Pekin:** All cement, 3 miles.
**Quincy:** Cement, 150,000 sq. ft.
**Rockford:** Cement, 10 miles.
**Streator:** Brick, about 5,000 sq. ft.
Cement, about 10,000 sq. ft.
**Taylorville:** 15 miles.
**Waukegan:** Cement, 10,000 sq. ft.
**Wood River:** 4,000 sq. yds.

### INDIANA.

**Anderson:** Cement, 4,000 lin. ft., 5-ft. wide.
**Bloomington:** Cement, 10,000 lin. ft.
**Connersville:** Cement, 25,000 sq. ft.
**Covington:** Cement, 4,300 sq. ft.
**Crawfordsville:** Cement, 17,000 sq. ft.
**Fort Wayne:** Cement, 10 miles.
**Gary:** Cement, 50,000 sq. yds.
**Hartford City:** Cement, 4,400 sq. yds.
**Huntington:** Repairs only.
**Lafayette:** Cement, 6,850 ft. long, 5-ft. wide.
2,398 ft. long, 5-ft. wide.
1,140 ft. long, 5-ft. wide.
**North Vernon:** Cement, 1,500 sq. yds.
**Plymouth:** A little.
**Portland:** 2 miles.
**Richmond:** Cement, 10,770 lin. ft.
**Terre Haute:** Not determined yet by Board of Works.

### IOWA.

**Burlington:** Cement, 3 miles 4-ft. walk.
**Cedar Rapids:** Cement, 6 miles.
**Clinton:** Cement, 10,000 sq. ft.
**Hamburg:** Cement, 500.
**Independence:** Cement, about 2½ miles.
**Muscatine:** 6 miles.
**Nevada:** Cement, 3,000 sq. yds.
**Oskaloosa:** Cement, about 2 miles.

### KANSAS.

**Arkansas City:** Cement, 10,000 sq. yds.
**Emporia:** Cement, 3,000 sq. yds., or 1¼ miles.
**Ft. Scott:** 1 mile.
**Girard:** Will probably be 10 blocks of concrete and brick sidewalks.
**Great Bend:** 1 mile.
**Manhattan:** 2 miles.
**Newton:** Cement, 6,000 sq. yds.
**Osawatomie:** 1 mile.
**Paola:** Cement, 1,000 ft.
**Pittsburg:** Brick, 3,000 ft.
**Salina:** Brick, ½ mile.
Cement, ¼ mile.
**Topeka:** 12 miles.
**Wichita:** Cement, 3 miles.

### KENTUCKY.

**Ashland:** 1,500 to 2,000 ft.; material not designated.
**Earlington:** Brick, 1,000 lin. ft., 4 ft. wide.
Cement, 550 lin. ft., 4 ft. wide.
**Louisville:** 12 miles.
**Ludlow:** 1 mile.
**Owensboro:** 2 miles.
**Paducah:** Cement, 25,000 sq. ft.
**Pikeville:** Have established grades and adopted specifications for all sidewalks in the town.
Cement, probably 1,000 ft., 5 and 6-ft.

### MAINE.

**Lewiston:** Brick, usual amount.
Cement, usual amount.
**Pittsfield:** A little.
**Rockland:** Tar concrete, 2,500 sq. yds.

### MARYLAND.

**Baltimore:** 30 miles.

### MASSACHUSETTS.

**Fitchburg:** Several granolithic sidewalks.
**Lawrence:** Cement, about 1 mile.
Tar concrete, between 3 and 4 miles.

**Lowell:** 2 miles.
**Southbridge:** Cement, 4,000 lin. ft., 6 ft. wide.
**Westfield:** Cement, 2,000 sq. yds.
Tar concrete, 200 sq. yds.

### MICHIGAN.

**Alpena:** Cement, probably 1½ miles.
**Cadillac:** 1 mile.
**Escanaba:** ½ mile.
**Highland Park:** Cement, 25,000 to 40,000 lin. ft. 6-ft. walk.
**Holland:** Cement, 1 mile.
**Port Huron:** Cement, about 4,000 sq. yds.
**Saginaw:** Cement, depends on amount allowed by Board of Estimates.

### MINNESOTA.

**Albert Lea:** Cement, 1 mile.
**Bemidji:** 1 mile.
**Fergus Falls:** About 3,000 sq. yds cement.
**Mankato:** Cement, 1½ miles.
**Minneapolis:** Cement, 30 miles.
**Montevideo:** Cement, 2000 lin. ft.
**South St. Paul:** 2 miles.
**Winona:** Cement, 2000 lin. ft. (by city).

### MISSISSIPPI.

**Clarksdale:** Cement concrete, 2,500 sq. yds.
**Hattiesburg:** Cement, 1 mile (private).
**Vicksburg:** 2 miles.

### MISSOURI.

**Columbia:** Cement, 14,939 sq. ft.; part let and more to come up later.
**Fulton:** Cement, 2 miles 4-ft. walk.
**Hannibal:** Cement, 4 miles.
**Jefferson City:** All cement; cannot estimate amount.
**Kansas City:** Cement, 25 miles, all 5 ft. wide.
**Kirksville:** 8 miles.
**Liberty:** Cement, 2,200 sq. yds.
**Nevada:** Brick, 1,000 lin. ft.
Cement, 3,000 lin. ft.
**Poplar Bluff:** Cement, 3 miles.
**Sedalia:** Cement, 10 miles.
**Springfield:** Cement, 10 miles.
**Webb City:** Cement, 3 miles.

### MONTANA.

**Bozeman:** 4 miles.
**Dillon:** Cement, 5,000 lin. ft., 6-ft.
**Great Falls:** Cement, 120,000 sq. ft.
**Helena:** Cement, 30,000 sq. yds.
**Lewistown:** Cement, 4,000 lin. ft., contemplated.

### NEBRASKA.

**Falls City:** Cement, 1,000 sq. yds.
**Lincoln:** Brick, ½ mile.
Cement, 9 miles.
**Norfolk:** Cement, 2 miles.
**Tecumseh:** 1 mile.
**University Place:** Cement, ¼ mile.

### NEVADA.

**Reno:** Cement, 3 miles.

### NEW HAMPSHIRE.

**Laconia:** 1 mile.

### NEW JERSEY.

**Bayonne:** 16 miles.
**Dover:** Put down by property owners.
**Newark:** Cement, 5 miles.
Stone, 3 miles.
**Ocean City:** Cement, 60,000 sq. ft.
Gravel, 20,000 sq. ft.
**Plainfield:** Mainly done by private owners.
**Ridgewood:** Done by property owners.
**Rutherford:** Cement, about 1 mile.
**South Orange:** Cement, 1 mile.
**West New York:** Cement, 20,000 sq. ft.
Stone, 32,000 sq. ft.

### NEW YORK.

**Binghamton:** Cement, 25,000 lin. ft., 5 ft. wide.
**Cortland:** Cement, 1 mile.
**Elmira:** Cement, 4 miles.
**Hudson:** 4 miles.
**Ilion:** Cement, 4,000 lin. ft.
**Jamestown:** 8 miles.
**Niagara Falls:** Cement, 3 miles.
**Norwich:** By private contract.
**Ogdensburg:** Cement sidewalks, 10,000 sq. yds.
**Schenectady:** Cement, 14,500 sq. yds.
**Syracuse:** Cement, 7 miles.
**Watertown:** Cement, 6 miles.

### NORTH CAROLINA.

**Greensboro:** Cement, 10,000 ft.
**Lumberton:** Cement, 2,500 ft.
**Rocky Mount:** Cement, about 20,000 yds.; contract already let at 99 cents per sq. yd.
**Wilmington:** Cement, 10,000 sq. yds.

### NORTH DAKOTA.

**Bismarck:** Cement, 1,200 sq. yds.
**Dickinson:** 1 mile.
**Minot:** Cement, 1 mile.
**Valley City:** 2 miles.
**Williston:** Cement, 7,320 sq. yds.

### OHIO.

**Barberton:** Cement or stone, 5,000 ft. of 6-ft. walk.
**Bowling Green:** 1 mile.
**Cambridge:** Cement, 3,000 sq. yds.
**Canton:** Cement, 58,000 sq. ft.
2½-in. sawed stone, 11 miles, 5 ft. wide.
**Carrollton:** Brick, ½ mile.
**Chillicothe:** Cement, walks, curbs and gutters, 6,000 lin. ft.
**Conneaut:** Cement, 6,000 lin. ft.
**Lorain:** Cement, 10,000 sq. yds.
**Massillon:** Cement, 4,000 lin. ft.
Stone, private work.
**Newark:** Cement, 8 miles.
**Niles:** Cement, 1,000 lin. ft.
Stone, 8,000 lin. ft.
**Pomeroy:** 1 mile.
**Ravenna:** Cement and stone; repairs and extensions; amount not yet determined.
**Springfield:** Cement, 15,000 sq. yds.
**Steubenville:** Cement, 1 mile.
**Tiffin:** Sidewalks are built by the property owners.
**Wooster:** Stone, 5 miles.

### OKLAHOMA.

**Chandler:** 3 miles.
**Clinton:** 1 mile.
**Durant:** 2 miles.
**El Reno:** 2 miles.
**Okmulgee:** 8 miles.
**Tulsa:** 3 miles.

### OREGON.

**Coquille:** Cement, 9,400 ft.
Wood, 1,500 ft.
**Eugene:** Cement, 3,000 lin. ft., 5 ft. wide.
Wood, 1,200 lin. ft., 6 ft. wide.
**Grant's Pass:** 5 miles.
**McMinnville:** 5 miles.

### PENNSYLVANIA.

**Catasauqua:** Cement, 600 lin. ft.
**Dravosburg:** Cement, 7,000 sq. yds.
**Du Bois:** Stone, uncertain.
**Erie:** Cement, 8,000 ft.
**Farrell:** Cement or stone, 5,000 ft.
**Hanover:** There will be quite a great deal of sidewalk work done here this year, but have no way of telling how much nor kind at this time, but either of brick or cement.
**Harrisburg:** Not done by city; 15 miles.
**McKees Rocks:** Cement, 2,000 sq. yds.

**Meadville:** 3 miles.
**Monongahela:** Cement, 10,000 lin. ft.
**New Brighton:** Cement, 3,000 sq. yds.
**Norristown:** 2 miles.
**Ridgway:** Built by property owners.
**Sayre:** Cement, 2,000 ft. in detached sections put in by property owners.
**Sharpsville:** Cement, ¼ mile.
**Swissdale:** Cement, about 15,000 sq. ft.
**Titusville:** Cement, 2 miles, by property owners; none by city.
**Wilkes-Barre:** 3 miles.
**York:** Cement, 9,013 sq. yds.

**RHODE ISLAND.**

**East Providence:** Tar concrete, 4,000 sq. yds.
**Woonsocket:** Tar concrete, about 3,000 sq. yds.

**SOUTH CAROLINA.**

**Columbia:** Cement, $20,000.

**SOUTH DAKOTA.**

**Aberdeen:** 4 miles.
**Mitchell:** 3 miles.
**Sioux Falls:** Cement, 500 yds.

**TENNESSEE.**

**Memphis:** Cement, 500,000 sq. ft.

**TEXAS.**

**Bryan:** 2 miles.
**Paris:** Cement, 5 miles or more.
**Waxahachie:** Cement, 5 miles.

**UTAH.**

**Ogden:** 8 miles.
**Salt Lake City:** Cement, 30 miles.

**VERMONT.**

**Barre:** Cement, 2,500 sq. yds.
**Bellows Falls:** Cement, ½ mile.
Tar concrete, 1 mile.

**VIRGINIA.**

**Newport News:** Cement, about 1 mile.

**WASHINGTON.**

**Aberdeen:** Cement, 12,000 sq. yds.
Wood, 5,000 lin. ft.
**Pullman:** Cement, by property owners on order of city.
**Seattle:** Cement, 200,000 sq. yds.
Wood, 1,500,000 ft. B. M.
**Tacoma:** $90,000.
**Walla Walla:** Cement, 50,000 sq. ft.

**WEST VIRGINIA.**

**Parkersburg:** Cement, 50,000 sq. yds.

**WISCONSIN.**

**Appleton:** 8 miles.
**Baraboo:** 1 mile.
**Burlington:** Cement, 6,000 lin. ft.
**Kenosha:** 4 miles.
**Eau Claire:** Cement, ¾ mile.
**Madison:** Cement, laid by contractors for owners.
**Marinette:** Cement, 10,000 lin. ft. of 6-ft. walk.
**Oshkosh:** Cement, about 12 miles.
**Port Washington:** Cement, 1,000 ft.
**Sheboygan:** Cement, 18,000 lin. ft.
**Waukesha:** 6 miles.
**Waupaca:** Cement, 19,800 sq. ft.

**CANADA:**

**Chatham, Ontario:** Cement, 50,000 sq. ft.
**Guelph, Ontario:** Cement, 78,030 sq. ft., or 3 miles.
**Hamilton, Ontario:** Cement, 6,000 ft.
**Lethbridge, Alberta:** Cement, 3 miles, 5 ft. and 6 ft. wide.
**London, Ontario:** Cement, 10,000 ft.; width, 5 ft.
**Ottawa, Ontario:** Cement, 10 miles.
Wood, ½ mile.
**Regina, Sask.:** Cement, 65,000 sq. yds.
**Vancouver:** Not yet outlined.

**NOVA SCOTIA.**

**Halifax:** Cement, 10,000 yds.

# STREET GRADING FOR 1913

*Grading without paving is included in this list.*

**ALABAMA.**

**Dothan:** City grading force is reworking all streets in city limits.
**Gadsden:** $10,000.

**ARIZONA.**

**Nogales:** A little.

**CALIFORNIA.**

**Alhambra:** 4 miles.
**Fresno:** $50,000.
**Inglewood:** 43,000 cu. yds.
**Lodi:** About 200,000 cu. yds.
**Los Angeles:** 30 miles.
**San Bernardino:** A little.
**Sierra Madre:** 3,000 lin. ft.
**Vallejo:** 50,000 cu. yds.
**Visalia:** $30,000.
**Willits:** About 1,600 ft.

**COLORADO.**

**Ft. Collins:** A little.

**CONNECTICUT.**

**Ansonia:** Not determined yet.
**Hartford:** $22,000.
**Southington:** 1,000 ft.; about 5 miles state highway.

**DISTRICT OF COLUMBIA.**

**Washington:** Included in "New Work," given under Paving and Sidewalks.

**FLORIDA.**

**Dade City:** 6 miles.

**GEORGIA.**

**La Grange:** Cut one hill about 10,000 cu. yds., and grading for sidewalks about 5,000 cu. yds.

**IDAHO.**

**Weiser:** 65,000 cu. yds.

**ILLINOIS.**

**Alton:** 10,000 yds. of grading and shaping streets.
**Carlinville:** A little.
**East St. Louis:** 151,220 cu. yds.
**Edwardsville:** 2 miles.
**Galesburg:** 26,950 cu. yds.
**Greenville:** A little.
**Moline:** 50,000 cu. yds.
**Newton:** 2,960 cu. yds.
**Oak Park:** 86,800 cu. yds.
**Pekin:** Street grading, one-third of sq. yds. of pavement, goes with paving.
**Quincy:** 55,000 cu. yds.
**Waukegan:** 15,000 cu. yds.

**INDIANA.**

**Bloomington:** A little.
**Connersville:** 2,500 lin. ft.
**Crawfordsville:** 2,467 lin. ft. grading and graveling.
**Evansville:** $100,000 grading, curbs and gutters.

**Fort Wayne:** A little.
**Lafayette:** 3,680 ft. gravel roadway.
**Portland:** A little.
**Richmond:** 2,600 ft.

### IOWA.

**Burlington:** 30,000 cu. yds.
**Dubuque:** 20,000 cu. yds.
**Fort Madison:** 9,500 cu. yds.
**Hamburg:** 1 mile.
**Independence:** Cut and fill, about 5,000 yds.
**Muscatine:** $9,500.
**Nevada:** About $1,000 appropriated for grading the transcontinental route thru city.
**Oskaloosa:** Probably a mile of streets will be graded this year.

### KANSAS.

**Chanute:** 6,000 sq. yds. light work.
**El Dorado:** One street, about 2,000 ft. long and 30 ft. wide.
**Emporia:** 23,000 cu. yds.
**Fort Scott:** A little.
**Great Bend:** A little.
**Oswatomie:** A little.
**Paola:** 4,500 cu. yds.
**Topeka:** $10,000.

### KENTUCKY.

**Ludlow:** A little.
**Owensboro:** A little.
**Paducah:** None in sight yet, but we always do about 1½ miles of grading and graveling streets during year.

### MAINE.

**Saco:** $7,000.

### MASSACHUSETTS.

**Lowell:** $5,000.
**Southbridge:** 3 mi. of drainage and subgrade.

### MICHIGAN.

**Cadillac:** A little.
**Escanaba:** A little.
**Grand Rapids:** 100,000 cu. yds.
**Highland Park:** Several street opening jobs which will probably be handled by Department of Public Works.
**Holland:** 10,000 yds.

### MINNESOTA.

**Albert Lea:** 18,000 cu. yds.
**Bemidji:** A little.
**Faribault:** 1 mile, gravel.
**Mankato:** ½ mile.
**Montevideo:** A little.
**South St. Paul:** $25,000.
**Winona:** A little.

### MISSISSIPPI.

**Vicksburg:** $5,000.

### MISSOURI.

**Columbia:** 7,727 cu. yds. excavation in conjunction with the paving, and will be or has been let in the same contract. 6,099 cu. yds. embankment, as above.
**Fulton:** 10,000 cu. yds.
**Hannibal:** 1½ miles.
**Kansas City:** 25 miles ;costing $230,000.
**Liberty:** 27,000 cu. yds.
**Sedalia:** 1 mile, 30 ft. wide.
**Webb City:** 1½ miles.

### MONTANA.

**Great Falls:** 1 mile, boulevard.
**Helena:** 3 mi.

### NEBRASKA.

**Lincoln:** Between 7,000 and 8,000 cu. yds.
**Norfolk:** 2,000 cu. yds.
**Tecumseh:** 2,500 cu. yds.
**University Place:** 8 blocks.

### NEVADA.

**Reno:** 5 miles.

### NEW HAMPSHIRE.

**Laconia:** $4,000.
**Littleton:** 2,600 ft.

### NEW JERSEY.

**Bayonne:** $8,000.
**Beach Haven:** Ocean boulevard, from Beach Haven to bridge, 7 miles, at cost of $15,000; 60 per cent. and 40 per cent. paid by county and state, respectively. (Gravel.)
**Newark:** 4 miles.
**Ocean City:** 4,000 ft.
**Rutherford, Boro of:** About 1 mile.
**Trenton:** 1,000 cu. yds.
**West New York:** 2 miles.

### NEW YORK.

**Binghamton:** Done by street department as required; no data.
**Jamestown:** $10,000.
**Schenectady:** 10,000 cu. yds.
**Syracuse:** 4 miles.

### NORTH CAROLINA.

**Greensboro:** 10,000 cu yds.
**Wilmington:** Small amount; number of cu. yds. not definite.

### NORTH DAKOTA.

**Bismarck:** 25,000 cu. yds.
**Dickinson:** A little.
**Minot:** 2 miles.
**Valley City:** $3,000.
**Williston:** 3,000 ft.

### OHIO.

**Bowling Green:** A little.
**Canton:** 140,000 cu. yds.
**Carrollton:** 2,000 cu. yds.
**Conneaut:** 2,200 lin. ft.
**Fostoria:** About three acres of cemetery to be laid out.
**Massillon:** 15,000 cu. yds.
**Steubenville:** 8,000 cu. yds.
**Wellsville:** 3,000 cu. yds.

### OKLAHOMA.

**Clinton:** $5,000.
**El Reno:** A little.
**Okmulgee:** A little.
**Tulsa.** $25,000.

### OREGON.

**Coquille:** 36,000 cu. yds.
**Eugene:** Some very light work.
**Grants Pass:** $7,000.

### PENNSYLVANIA.

**Athens:** 1,200 ft.
**Catasauqua:** 500 cu. yds.
**Dravosburg:** 18,000 cu. yds.
**Farrell:** Very little, except grading for our paved streets, contemplated.
**Hanover:** About 800 cu. yds. in prospect.
**Harrisburg:** 2,305 lin. ft.
**McKees Rocks:** 10,000 cu. yds.
**New Brighton:** $5,000.
**New Castle:** 20,000 cu. yds.
**Norristown:** A little.
**Sayre:** 1,200 ft. for paving.
**Swissvale:** 19,000 cu. yds.
**Titusville:** Ordinary repairs.

### RHODE ISLAND.

**East Providence:** 4,200 lin. ft.

### SOUTH CAROLINA.

**Columbia:** 10,000 cu. yds.; contracts let.

### TENNESSEE.

**Columbia:** 7,700 ft. in length.
**Memphis:** 100,000 cu. yds.

**TEXAS.**

**Bryan:** $40,000.
**El Paso:** $50,000.

**UTAH.**

**Ogden:** $10,000.
**Salt Lake City:** 10 miles.

**VIRGINIA.**

**Newport News:** About 12,000 cu. yds.

**WASHINGTON.**

**Aberdeen:** 500,000 cu. yds., of which four-fifths is already contracted.
**Grandview:** 4,000 ft.
**Hoquiam:** 50,000 cu. yds. filling.
**Seattle:** 3,000,000 cu. yds. grading.
**Tacoma:** $200,000.

**WISCONSIN.**

**Appleton:** $5,000.
**Baraboo:** A little.
**Kenosha:** $18,000.
**Port Washington:** 5,000 yds.
**Sheboygan:** 6,000 yds.
**Waukesha:** 21,042.60 cu. yds.

**CANADA.**

**Guelph, Ontario:** About 5 miles.
**Hamilton, Ontario:** 32,000 cu. yds.
**Lethbridge, Alberta:** 1 mile.
**London, Ontario:** 2,000 ft.
**Ottawa, Ontario:** Not decided yet.
**Prince Rupert, B. C.:** $160,000 grading.
**Regina, Sask.:** 20 miles.

**NOVA SCOTIA.**

**Halifax:** 4,000 ft.

## CURB AND GUTTER FOR 1913

*Curb and gutter on streets which are not paved are included in this list.*

**ALABAMA.**

**Dothan:** Indefinite.
**Gadsden:** Concrete, 2 miles.
**Jasper:** Concrete, 1 mile.

**ARKANSAS.**

**Paragould:** Concrete, 20,000 ft.

**CALIFORNIA.**

**Alhambra:** Concrete, 4 miles.
**Colton:** Brick or concrete, 24,000 sq. ft.; have not decided which material.
**Huntington Beach:** Concrete, 1 mile.
**Imperial:** Concrete, 10 miles.
**Inglewood:** Concrete, 31,610 lin. ft. curb; 63,220 sq. ft. gutter.
**Lodi:** Concrete, about 7,000 lin. ft. curb and gutter.
**Los Angeles:** Brick and cement gutter, 10 miles.
Concrete curb, 90 miles.
**Oroville:** Concrete, 1 mile.
**Palo Alto:** Concrete, 10,000 sq. ft.
**Pasadena:** Concrete, 5,000 ft.
**Vallejo:** Concrete, 50,000 lin. ft.
**Willits:** Concrete, 7,000 ft.

**CONNECTICUT.**

**Ansonia:** Granite, 5,000 ft.
**Middletown:** Considerable repair of macadam streets.
**Torrington:** Concrete, 5,500 lin. ft.
Cobble, 2,000 lin. ft.
**Wallingford:** Concrete, 1,000 ft.
Blue stone, 2,000 ft.

**DISTRICT OF COLUMBIA.**

**Washington:** Brick gutter and granite curb, included in resurfacing and new work.

**IDAHO.**

**Weiser:** Concrete, 90,000 lin. ft.

**ILLINOIS.**

**Alton:** Concrete, 5 miles.
**Assumption:** Sandstone, 3,076 ft. let; 10,800 ft. not let.
**Bloomington:** Concrete, 31,862 lin. ft.
Sandstone, 4,091 lin. ft.
**Canton:** 35 miles; material not decided.
**Carlinville:** Concrete, 4,000 lin. ft.
**Chicago Heights:** Concrete, 12,000 lin. ft.
**Dixon:** Concrete curb, 10,000 lin. ft.
**East St. Louis:** Concrete, 1,000 ft. (combined curb and gutter).
Sandstone, 107,982 ft.
Concrete marginal curb, 46,807 ft.
**Edwardsville:** Concrete, 3,500.
**Elgin:** Concrete, 7½ miles.
**Galesburg:** Concrete, 32,330 lin. ft.
Sandstone, 2,230 lin. ft.
**Granite City:** Granite, 5,200 lin. ft.
**Moline:** Concrete, 60,000 ft.
**Newton:** Concrete, 5,632 lin. ft.
**Normal:** Concrete, 8,000 ft.
**Oak Park:** Concrete, 28 miles.
**Olney:** Brick; can not say.
Concrete; can not say.
**Pekin:** Concrete, 5,000 lin. ft. new.
Sandstone, 15,000 lin. ft. re-set.
**Quincy:** Concrete, about 6 miles.
Sandstone, about 4,000 ft.
**Rockford:** Concrete, 20,000 lin. ft.
9,300 lin. ft. curb only.
**Streator:** Concrete, 3,600 ft.
Sandstone, 2,600 ft.
**Waukegan:** Concrete, 20,000 ft. combined curb and gutter.
Sandstone, 1,050 ft.
**Wood River:** Concrete, 20,000 lin. ft.

**INDIANA.**

**Bloomingon:** Concrete, 5,000 ft.
**Connersville:** 5,000 ft.
**Covington:** Concrete, 5,200 ft. curb.
**Crawfordsville:** Concrete, 30,655 lin. ft.
**Fort Wayne:** None, except in connection with new paved streets.
**Gary:** Concrete, 85,000 ft.
**Hartford City:** Concrete, about 15,000 lin. ft.
**Lafayette:** Concrete, 3,820 lin. ft.
**North Vernon:** Concrete, 2,500 lin. ft.
**Richmond:** Concrete, 9,391 ft.

**IOWA.**

**Burlington:** Concrete, 20,200 curb.
**Cedar Rapids:** Concrete, 60,000 lin. ft.
**Clinton:** Concrete, 10,000 lin. ft.
**Corning:** Concrete, 17,000 ft.
**Dubuque:** Concrete, 20,000 lin. ft.
Limestone, 2,000 lin. ft.
**Eagle Grove:** Cement, about 16,000 ft.
**Fort Madison:** Concrete, 11,400 lin. ft.
**Hamburg:** Concrete, 8,000 ft.
**Independence:** Concrete, 14 blocks, combined curb and gutter.
**Nevada:** Concrete, about 15 blocks combined curb and gutter. Possibly 10 more.
**Newton:** Concrete, 24,000 ft.
**Oskaloosa:** Concrete, possibly 10 to 20 blocks.
**Webster City:** Concrete, about 20,000 ft.

### KANSAS.

**Arkansas City:** Concrete, 10,000 lin. ft.
**Chanute:** Concrete, 3,000 ft. curbing and gutter.
**El Dorado:** Concrete, not certain, but probably about 4,000 lin. ft.
**Emporia:** Concrete, 12,000 lin. ft. combined curb and gutter.
**Girard:** Concrete, 1,300 ft., contract let; will probably be more.
**McPherson:** Concrete, about 3 miles.
**Newton:** Concrete, 5 miles.
**Ottawa:** Concrete, 5,700 lin. ft.
**Paola:** Concrete, 10,000 ft.
**Pittsburgh:** Concrete, 40,000 ft.
**Salina:** Concrete, 2 miles.
**Wichita:** Concrete, 2 miles.

### KENTUCKY.

**Ashland:** Very little.
**Paducah:** Granite, 4,000 ft.
**Pikeville:** Concrete, 20,000 lin. ft. combined curb and gutter.

### LOUISIANA.

**Baton Rouge:** Are talking of issuing bonds for some curbs and gutters, etc., but nothing definite.
**New Orleans:** Vitrified brick gutter bottoms.
Combined concrete curb and gutter, 36,000 lin. ft.
Concrete curb, 26,600 lin. ft.
Granite curb, 18,700 lin. ft.
31,900 lin. ft.

### MASSACHUSETTS.

**Lawrence:** Between 3 and 4 miles.
**Southbridge:** Concrete, 4,000 ft. long, 2-foot wide.
**Westfield:** Concrete, 300 lin. ft.

### MICHIGAN.

**Alpena:** Concrete, probably 3,500 lin. ft., curb without gutter.
**Hastings:** Concrete, curb and gutter for 16 blocks.
**Highland Park:** Concrete, as required for paving work.
**Hillsdale:** Concrete, about 1 mile.
**Holland:** Concrete, 4 miles.
**Port Huron:** Concrete curb, 2 miles.
**Saginaw:** Concrete, 15,000 ft. combined curb and gutter.
Medina curb, 9,000 ft.

### MINNESOTA.

**Albert Lea:** Concrete, 6 miles without gutter.
**Faribault:** Sandstone, 6,000 ft.
**Mankato:** Concrete, 1 mile.
**Minneapolis:** Concrete, 70 miles.
Granite, 2 miles.
**Montevideo:** Concrete, 600 lin. ft.
**Stillwater:** Concrete, possibly ½ mile.
**Winona:** Limestone, 1,500 ft.

### MISSISSIPPI.

**Clarksdale:** Concrete, 1,000 lin. ft.

### MISSOURI.

**Columbia:** Concrete, 7,971 lin. ft.
**Fulton:** Concrete, 2,500 ft.
**Hannibal:** Concrete, 20,000 lin. ft.
**Jefferson City:** Concrete, 6 miles.
**Kansas City:** Concrete, 32 miles.
**Kirksville:** Concrete, 5,300 lin. ft.
**Liberty:** Concrete, 10,000 lin. ft.
**Nevada:** Concrete, 2,000 lin. ft.
**Poplar Bluff:** Concrete, 4 miles.
**Sedalia:** Concrete, 3 miles.
**Springfield:** Concrete, 7 miles.
Limestone, 7 miles.
**Webb City:** Concrete, 2 miles.

### MONTANA.

**Dillon:** Concrete curbs, 1,000 lin. ft.
**Great Falls:** Concrete, 30,000 lin. ft. curb.
**Helena:** Concrete, 30,000 lin. ft.
**Lewistown:** Brick, contemplated, 4,000 yds.

### NEBRASKA.

**Falls City:** Concrete, 5,000 ft.
**Lincoln:** Concrete, about 7 miles.
**Norfolk:** Concrete, 40,000 lin. ft.
**University Place:** Concrete, 6 blocks.

### NEVADA.

**Reno:** Concrete, 2 miles.
Granite, 1 mile.

### NEW JERSEY.

**Ocean City:** Bluestone, 10,000 lin. ft.
**Plainfield:** Mainly done by private owners.
**Ridgwood:** Concrete, 700 ft. gutter.
**Rutherford, Boro. of:** Concrete, about 1 mile.
**South Orange:** Brick, 2 miles gutter.
Concrete, 3 miles curb.
**Westfield:** Concrete, 3¼ miles.
**West New York:** Bluestone, 3,000 ft.

### NEW YORK.

**Binghamton:** Concrete, 10,000 lin. ft.
**Cortland:** Concrete, 6,000 lin. ft.
**Elmira:** Concrete, 3,000 lin. ft.
Sandstone, 12,000 lin. ft.
**Ilion:** Concrete, 2 miles combined curb and gutter.
**Niagara Falls:** Laid only with new pavement.
**Norwich:** Built by property owners.
**Ogdensburg:** Concrete curb and gutter, 8,000 ft.
**Rye:** Brick, 5,000 lin. ft. gutters.
Bluestone, 5,000 lin. ft. curb.
**Schnectady:** Granite, 45,000 lin. ft.
Bluestone, 2,000 lin. ft.
**Syracuse:** Concrete, 2 miles.
Sandstone, 10 miles, curb.
**Watertown:** Concrete, 1 mile.

### NORTH CAROLINA.

**Greensboro:** Granite, 10,000 ft.
**Rocky Mount:** Granite, about 3 miles.
**Wilmington:** Granite, 15,000 ft.

### NORTH DAKOTA.

**Bismarck:** Concrete, 3,000 lin. ft.
**Minot:** Concrete, 20,000 ft.
**Williston:** Concrete, 12,560 ft.

### OHIO.

**Barberton:** Concrete curb and gutter, 4,200 ft.
Sandstone curb, 5,538 ft., 18x4-inch.
**Bowling Green:** Sandstone, 2,500 ft.
**Bryan:** Cement curb and gutter, for 25,200 sq. yds. paving.
**Cambridge:** Sandstone, Berea curb for 22,500 sq. yds. of pavement.
**Canton:** Stone curb, 14 miles, 6x18-inch.
**Carrollton:** Sandstone, 1,100 lin. ft.
**Chillicothe:** Curbs and gutter for 6,000 lin. ft. cement walk.
**Conneaut:** Concrete, 4,400 lin. ft.
**Coshocton:** Sandstone, 6,300 sq. yds.
**Massillon:** Brick, 10,200 ft. block gutter.
Concrete, 5,000 lin. ft.
Sandstone, 5,200 lin. ft.
**Newark:** Concrete, 25,143 lin. ft. curb, 6-inch by 16-inch.
**Paulding:** Concrete curb and gutter.
**Pomeroy:** Concrete, 4,000 ft.
**Ravenna:** Brick or concrete, 6,865 ft.
**Springfield:** Concrete, 14,000 ft.
**Steubenville:** Concrete, 2 miles.
**Tiffin:** Concrete curb for 2,615 sq. yds. concrete paving.
Sandstone curb for 14,800 sq. yds. brick paving.
**Wellsville:** Concrete, 7,000 ft.
**Wooster:** Sandstone, 20,000 lin. ft. curb.
**Zanesville:** Concrete curb, 55,000 lin. ft.

**OKLAHOMA.**

**McAlester:** Concrete, 2,000 ft.

**OREGON.**

**Coquille:** Concrete, 32,000 lin. ft.
Red cedar, 2,600 lin. ft.
**Eugene:** Concrete, 55,000 lin. ft.

**PENNSYLVANIA.**

**Athens:** Concrete, about 2,400 lin. ft.
**Catasauqua:** Concrete, 600 lin. ft.
**Dravosburg:** Concrete, 7,000 lin. ft.
**DuBois:** Concrete, 3,000 lin. ft.
**Erie:** Concrete, 11,000 ft. curb.
**Farrell:** Concrete, granite, limestone or sandstone, 5,000 ft. curb.
**Hanover:** Concrete, 25,000 lin. ft.
**Harrisburg:** Granite, 53,352 lin. ft.
**McKees Rocks:** Concrete, 10,000 lin. ft.
Sandstone, 5,000 lin. ft.
**Monongahela:** Concrete, 12,800 lin. ft.
**New Brighton:** Concrete, 2,500 ft.
**New Castle:** Brick, 5 miles.
Concrete, 10,000 ft.
Sandstone, 10,000 ft.
**Ridgway:** Sandstone curb for 11,000 sq. yds. brick pavement.
**Sayre:** Concrete, 2,400 ft.
**Sharpsville:** Very little, if any.
**Swissvale:** Concrete, 15,000 lin. ft.
**York:** Concrete, 30 miles curb.

**RHODE ISLAND.**

**Woonsocket:** Granite, about 1 mile.
**Sioux Falls:** Concrete, 10,000 lin. ft.

**TENNESSEE.**

**Memphis:** Concrete, 100,000 sq. ft. of "water table."
Concrete curb and gutter, about 20,000 lin. ft.

**TEXAS.**

**Paris:** Concrete, 27,000 ft.
**Waxahachie:** Concrete, 5 miles.

**UTAH.**

**Ogden:** Concrete, 15,500 lin. ft.
Plain concrete gutter, 5,229 ft.
**Salt Lake City:** Concrete, 11.5 miles.

**VERMONT.**

**Barre:** Concrete, 1,000 ft.

**VIRGINIA.**

**Danville:** Appropriations not made.
**Newport News:** Concrete, 21,000 lin. ft. curb and gutter.

**WASHINGTON.**

**Aberdeen:** Concrete curb, 28,000 lin. ft.
**Pullman:** Concrete, 2,000 ft.
**Seattle:** Concrete, 30,000 lin. ft.
Granite, 15,000 lin. ft.
Reinforced concrete, 50,000 lin. ft.
Wood, 400,000 lin. ft.
**Walla Walla:** Concrete, 6,000 lin. ft.

**WEST VIRGINIA.**

**Parkersburg:** Concrete, 30,000 ft.

**WISCONSIN.**

**Delavan:** Concrete, 5,130 lin. ft.
**Eau Claire:** Concrete gutter, 1 mile.
**Madison:** Concrete, 30,000 ft.
**Oshkosh:** Concrete, 30,000 ft.
**Port Washington:** Not determined.
**Sheboygan:** Concrete, 36,000 ft.
Limestone, 2,000 ft.
**Waukesha:** Concrete, 26,500 lin. ft.
**Waupaca:** Concrete, 6,200 lin. ft., curb only.

**CANADA.**

**Chatham, Ontario:** Concrete, 2,400 ft.
**Guelph, Ontario:** 15,400 ft. of combined curb and gutter.
**Hamilton, Ontario:** Brick, 25,000 yds.
Concrete, 6,000 ft.
**Lethbridge, Alberta:** Concrete, 2 miles.
Plank, 2 miles.
**London, Ontario:** All concrete; can not give length.
**Ottawa, Ontario:** Concrete, 2 miles.
**Regina, Sask.:** Concrete, 80,000 lin. ft.
**Vancouver, B. C.:** Not yet outlined.

**NOVA SCOTIA.**

**Halifax:** Concrete, 10,000 ft.
Granite, 5,000 ft.

# SEWERS TO BE CONSTRUCTED IN 1913

**ALABAMA.**

**Dothan:** Plain concrete, 3,000 ft. 36 inch.
Vitrified pipe, new trunk lines of sanitary sewer. Survey not being made the size and length are not definitely known.
4,000 lin. ft. of open ditch outlet.
**Gadsden:** Vitrified pipe, 3,000 ft. 6-inch sanitary. City will do work.
**Jasper:** Vitrified pipe, 24,000 ft.

**ARIZONA.**

**Nogales:** A $50,000 system will be built.

**CALIFORNIA.**

**Alhambra:** Reinforced concrete, 8,000 ft.
**Fresno:** Pipe sewers, $10,000.
**Hanford:** Will issue $90,000 bonds for sewer extensions.
**Huntington Beach:** Vitrified pipe, complete system for ½ square mile area, from 6-inch to 15-inch and 45 manholes and catch basins; 1,000 ft. 12-inch c. i. outfall into ocean; estimated cost, $46,000.
**Imperial:** Vitrified pipe, 4,000 ft.
**Inglewood:** Corrugated iron, 7,300 lin. ft., 5-foot diameter.
**Lodi:** Plain concrete, 1,300 ft.
Vitrified pipe, 8,581 ft.
**Los Angeles:** Brick, plain concrete, reinforced concrete, vitrified pipe, 100 miles.
**Oakland:** Sanitary sewers (last year), 81 miles.
Storm sewers (last year), 3 miles.
**Oroville:** Vitrified pipe, 7,500 ft., 12-inch to 24-inch storm sewer; bids closed.
**Pasadena:** Vitrified pipe, 4 mi.
Small sewage pumping plant.
**San Bernardino:** Sewer pipe lines, $90,000.
**Santa Monica:** Making extensions.
**Vallejo:** Vitrified pipe, 5,000 lin. ft.
**Visalia:** Some short sewer lines.

**COLORADO.**

**Ft. Collins:** Some short lines.

**CONNECTICUT.**

**Ansonia:** Vitrified pipe, 12,000 ft.
**Middletown:** Vitrified pipe; prospective work, data not determined yet.
**Southington:** System under consideration.
**Torrington:** Vitrified pipe, 2,000 ft., 24-inch; 3,000 ft. 8-inch.
Segment blocks, 2,800 ft., 42-inch.
**Wallingford:** Vitrified pipe, 4,000 lin. ft., 12-inch to 24-inch.

### DISTRICT OF COLUMBIA.

**Washington:** Brick, plain concrete, vitrified pipe or other material, $430,000.

### FLORIDA.

**Dade City:** Vitrified pipe, 3,000 lin. ft. 18-inch.
Vitrified pipe, 17,000 lin. ft. 12-inch.
Vitrified pipe, 100,000 lin. ft., 8-inch.
With disposal works contemplated.
**Sarasota:** $15,000 to be spent on sewer construction.

### GEORGIA.

**Americus:** Sewer lines, $10,000.

### IDAHO.

**Boise City:** A few short lines.
**Weiser:** Vitrified pipe, 4,057 ft., 6-in.; 28,130 ft., 8-in.; 4,310 ft., 10-in.; 3,240 ft., 12-in.; 3,300 ft., 15-in.; 640 ft., 18-in.; 1,600 ft., 24-in.
105 concrete manholes.
Sewage pumping station.

### ILLINOIS.

**Alton:** Sanitary sewer as follows
Vitrified pipe, 12 miles, 8 to 15-inch and 6-inch laterals for house connections.
Cast iron pipe, 1½ miles, 12-inch to 20-inch in diameter.
**Assumption:** Vitrified pipe, 8 miles 8-inch to 30-inch; contract let.
**Bloomington:** Brick, 1,126 ft. of 5-foot.
Vitrified pipe, 15,844 lin. ft. of 24-inch, 20 inch, 15-inch, 12-inch, 10-inch and 8-inch.
**Canton:** Vitrified pipe, about 8,000 ft.
**Carlinville:** A few appurtenances will be built.
**Centralia:** Vitrified pipe, 5 miles extension.
Will remodel septic tank and built two new tanks.
**Chicago Heights:** Plain concrete, 12,918 lin. ft., 30-inch to 84-inch.
Vitrified pipe, 141,458 lin. ft., 6-inch to 24-inch.
5,000 lin. ft. outlet ditch, ex. 4½ cu. yds. per lin. ft.
**DeKalb:** Vitrified pipe, about 16 miles, 8-inch to 24-inch.
**Dixon:** Vitrified pipe, about 10,000 lin. ft.
**East St. Louis:** Plain Concrete, 5,976 ft. 5-foot, diam.; 5,477 ft. 4½-foot diam.; 4,564 ft. 4-ft. diam.; 6,289 ft. 3½-foot diam.; 7,395 ft. 3-foot. diam.
Reinforced Concrete, 3,768 ft. 7-foot. diam.; 970 ft. 6½-foot diam.; 2,651 ft. 6-foot diam.
Vitrified Pipe, 720 ft. 36-inch diam.; 19,591 ft. 30-inch diam.; 3,792 ft. 27-inch diam.; 27,650 ft. 24-inch diam.; 8,074 ft. 20-inch diam.; 5,360 ft. 18-inch diam.; 11,460 ft. 15-inch diam.; 9,650 ft. 12-inch diam.; 26,000 ft. 10-inch diam.
Sewage pumping station.
**Edwardsville:** Vitrified pipe, 8,000 ft.
**Elgin:** Vitrified pipe, 12½ miles 6-inch to 42-inch.
**Galesburg:** Vitrified pipe, 12,782 lin. ft., 10-inch, 12-inch, 15-inch, 18-inch, 20-inch, 24-inch and 27-inch, inclusive.
**Granite City:** Vitrified pipe, 4,000 ft., 39-inch.
2,600 ft., 36-inch.
**Lake Forest:** Vitrified pipe, about 1,000 ft. in all; storm water sewer sewer, 12-inch, 12-inch, 15-inch, 18-inch, 27-inch and 30-inch.
**Mattoon:** Plain concrete, 640 ft. of 48-inch.
Vitrified pipe, 30 miles, sanitary sewer system.
**Moline:** Vitrified pipe, 12 miles.
**Normal:** Vitrified pipe, 2,000 ft.
**Oak Park:** Some short branches.
**Olney:** Not yet determined.
**Ottawa:** Vitrified pipe, about 4 miles, from 6-inch to 30-inch.
**Pontiac:** Vitrified pipe, 7,500 ft.
**Quincy:** Brick, 36-inch to 40-inch, 4,200 ft. (contracted).
Vitrified pipe, about 6 miles contracted; about 1 mile prospective.
**Rockford:** Vitrified pipe, 30,000 lin. ft.
**Rock Island:** Sewer mains, $30,000.
**Waukegan:** Vitrified pipe, 5,600 ft.
**Wood River:** Vitrified pipe, 4,200 ft. 6-in., 300 ft. 12-inch, 500 ft. 15-inch.

### INDIANA.

**Anderson:** Plain concrete, 8,000 ft. 7x9.
Vitrified pipe, 2,000 ft., 42-inch; 1,000 ft. 39-inch; 1,000 ft. 24-inch.
**Bedford:** Sewer pipe lines, $20,000.
**Bloomington:** Reinforced concrete, 500 ft., 5 ft. by 6 ft.
Vitrified pipe, 10,000 ft.; sanitary and storm.
**Boonville:** Sewer system, $75,000.
**Crawfordsville:** Vitrified pipe, 750 lin. ft., 24-inch; 957 lin. ft., 30-inch; 400 lin. ft., 10-inch.
**Evansville:** Sewer extensions, $16,000.
**Fort Wayne:** Vitrified pipe, 9 miles, 12-inch to 36-inch.
**Gary:** Plain concrete, 18,000 ft.
Vitrified pipe, 28,000 ft.
**Hartford City:** Vitrified pipe. 4,000 ft. 12-inch.
**Huntington:** Vitrified pipe, 2,000 ft. 12-inch, and 1,900 ft. 15-inch.
**Lafayette:** Vitrified pipe—720 ft. 24-inch.
490 ft. 18-inch S. S. pipe.
335 ft. 12-inch S. S. pipe.
**Logansport:** Very little.
**Michigan City:** Concrete, 1 mile long, from 24-inch to 36-inch diameter; cost $100,000.
**Plymouth:** Some short branches.
**Portland:** Sewer extensions, $10,000.
**Richmond:** Reinforced concrete, 1,100 ft.
Vitrified pipe, 14,973 ft.
**Terre Haute:** Not yet determined by board of works.

### IOWA.

**Burlington:** Vitrified pipe, 30,000 ft. 8-inch to 24-inch.
**Carroll:** Vitrified pipe, about 3 miles of 8-inch sanitary sewer.
**Cedar Rapids:** Brick, storm sewer, 2,840 ft., 5 and 6-foot.
Vitrified pipe, sanitary sewer, 10,000 ft.
**Clinton:** Vitrified pipe, 4 miles, 3-inch to 30-inch.
**Dubuque:** Vitrified pipe, 20,000 ft. 8-inch and 10-inch.
Stone, 500 lin. ft., 14 feet semi-circle.
**Independence:** Vitrified pipe. 1¼ miles.
**Marshalltown:** Sewer and water extensions, $25,000.
**Muscatine:** Some branches will be built; $7,000.
**Oskaloosa:** Vitrified pipe, 1 to 3 miles, 12-inch to 8-inch in size, sanitary.
Vitrified hollow block, 5,700 ft., storm.
Vitrified pipe, 7,800 ft. 24-inch to 12-inch.
**Webster City:** Vitrified pipe, about 6,800 ft.

### KANSAS.

**Arkansas City:** Vitrified pipe, 5,000 lin. ft. 8-inch; under construction.
**Chanute:** Vitrified pipe, 2,100 ft, 8-inch tile.
**Emporia:** Vitrified pipe, 8,000 ft. 15-inch; 1,500 ft. 14-inch; 6,000 ft. 12-inch; 3,000 ft. 10-inch.
**Fort Scott:** Large sewer construction, $100,000.
**Girard:** Vitrified pipe, 4,000 ft. of 8-inch.
**Newton:** Reinforced concrete, 3,000 ft. of 60-inch.
**Paola:** Vitrified pipe, 1,500 ft. 8-inch.

**Pittsburg:** Vitrified pipe, 4,000 ft. of 8-inch.
**Salina:** Vitrified pipe, 4,000 ft. 30-inch.
**Topeka:** Sewer extensions, $25,000.
**Wichita:** Reinforced concrete, 360 lin. ft.
Vitrified pipe, 6,994 lin. ft.

### KENTUCKY.

**Dayton:** Some short branches.
**Louisville:** Completion of large sewer system in progress; will probably spend $1,000,000 in 1913.
**Ludlow:** Some small branches.
**Pikeville:** Vitrified pipe, 2,000 ft. of 30-inch 70 catch-basins, 8-inch inlets; average length inlets, 10 ft.

### LOUISIANA.

**Baton Rouge:** Will spend $50,000 for sewers if bonds are issued as talked of now.
**New Orleans:** 20 miles of sewers in prospect.

### MAINE.

**Lewiston:** Brick, 700 ft. 48-inch.
Vitrified pipe, about 3,000 ft.
**Pittsfield:** Small branches.
**Rockland:** Vitrified pipe, 2,000 ft. of 8-inch and 10-inch.

### MARYLAND.

**Baltimore:** Sewer system under rapid construction; about $2,000,000 construction planned for 1913.

### MASSACHUSETTS.

**Great Barrington:** Not yet determined.
**Lawrence:** Vitrified pipe, between 1 and 2 miles.
**Lowell:** Extensions, $50,000.
**Southbridge:** Vitrified pipe, 3,000 lin. ft. 8-inch.
**Westfield:** Vitrified pipe, 2,000 ft. 8-inch to 18-inch.

### MICHIGAN.

**Alpena:** Vitrified pipe, about 3,000 ft.
**Cadillac:** $17,000.
**Detroit:** Eight sewers as follows:
2,540 ft. 3-ft. cyl., 12, 15, 18 and 27-inch pipe.
1,155 ft., 12-inch pipe.
254 ft., 15-inch pipe.
589 ft., 12-inch to 15-inch pipe.
1,038 ft., 12-inch, 15-inch and 20-inch pipe.
1,989 ft., 12-inch, 15-inch, 18-inch and 20-inch pipe.
1,182 ft., 12-inch, 15-inch and 27-inch pipe.
2,385 ft., 12-inch, 15-inch, 18-inch and 27-inch pipe.
**Escanaba:** Sewer system and disposal plant, $120,000.
**Grand Rapids:** Sewer extensions, $80,000.
**Granville:** No work laid out; use vitrified pipe in all sewers.
**Highland Park:** Not determined as yet.
**Hillsdale:** Vitrified pipe, about 2,500 ft. 8-inch and 12-inch.
**Holland:** Vitrified pipe, 1 mile.
**Iron Mountain:** Reinforced concrete, 1,650 ft. of 48-inch.
Iron pipe, 1,650 ft. of 12-inch diam.
**Saginaw:** Plain concrete, 1 mile.
Reinforced concrete pumping stations.
Vitrified pipe, 3 miles.

### MINNESOTA.

**Albert Lea:** Vitrified pipe, 1,500 ft. 10-inch.
9,700 ft. 8-inch.
**Bemidji:** Some short branches.
**Faribault:** Vitrified pipe, 5,425 ft. 8-inch.
660 ft. 9-inch.
410 ft. 10-inch.
870 ft. 24-inch.
**Fergus Falls:** Vitrified pipe, 1,000 ft. 15-inch; 900 ft. 12-inch; 700 ft. 8-inch.
**Mankato:** Reinforced concrete, 1,700 ft.
Vitrified pipe, 2,000 ft.
**Minneapolis:** Vitrified pipe, 20 miles.
**Montevideo:** Vitrified pipe, 1,200 ft. of 8-inch.
**St. Paul:** Extensions, $300,000.
**Stillwater:** Vitrified pipe, 2,000 ft. 6-inch to 24-inch.
Vitrified segment, 2,200 ft. of 30-inch to 36-inch.
**Winona:** Vitrified pipe, 1½ miles, 8, 12, 15, 20 and 24-inch.

### MISSISSIPPI.

**Clarksdale:** Vitrified pipe, 850 ft. 24-inch.
300 ft. 15-inch.
**Hattiesburg:** Vitrified pipe, 1,500 lin. ft. 8-inch.
**Vicksburg:** Branches, local sewers.

### MISSOURI.

**Eldorado Springs:** Branch sewers.
**Hannibal:** Plain concrete, 2 miles.
Reinforced concrete, 1,000 ft.
Vitrified pipe, 112,400 lin. ft.
**Jefferson City:** Vitrified pipe, 5 miles 8-inch; 3 miles 6-inch.
**Kansas City:** About 45 miles contemplated; sizes from 8-inch to 6-feet; materials admitted by specifications. Cost, $800,000.
**Kirksville:** Vitrified pipe laterals, 4,000 ft.
**Liberty:** Vitrified pipe, 500 ft. 8-inch.
**Nevada:** Vitrified pipe, 4,000 lin. ft.
**Poplar Bluff:** Vitrified pipe, 1 mile, 18-inch to 6-inch.
**Sedalia:** Brick, 1½ miles egg shape contemplated.
Vitrified pipe, 15 miles.
**Springfield:** Vitrified pipe, 5 miles, 12, 10 and 8-inch.
**Webb City:** Plain concrete, 200 ft.
Vitrified pipe, 4,000 ft.

### MONTANA.

**Bozeman:** Vitrified pipe branch sewers.
**Dillon:** Vitrified pipe, 12,000 lin. ft. 8-inch to 24-inch.
**Great Falls:** Reinforced concrete, 3,000 ft., 4-foot circular.
Vitrified pipe, 1½ miles 9-inch.
**Helena:** Vitrified pipe, 2,500 lin. ft. 8 and 10-inch.
**Lewistown:** Vitrified pipe, 6,000 ft. lateral.

### NEBRASKA.

**Lincoln:** Vitrified pipe, about 1½ miles of 8-inch.
**Norfolk:** Vitrified pipe, 2,500 ft. 8-inch to 18-inch.
**University Place:** Vitrified pipe, 1 mile.

### NEVADA.

**Reno:** Vitrified pipe, 1 mile.

### NEW HAMPSHIRE.

**Laconia:** Small pipe branches.
**Littleton:** Vitrified pipe, 500 ft. 10-inch.

### NEW JERSEY.

**Bayonne:** $10,000.
**Beach Haven:** Vitrified pipe, 1 mile main to ejectors; cost $21,000.
**Elizabeth:** $30,000 sewerage system will be constructed.
**Ocean City:** Vitrified pipe, 4,000 lin. ft.
**Plainfield:** Vitrified pipe, 1 mile, besides present contract.
**Ridgewood:** Plain concrete, 2,450 ft. 42-inch.
Reinforced concrete, 2,500 ft. 6-foot by 2½-foot.
Vitrified pipe, 1,500 ft. 24-inch; 1,200 ft. 6-inch and 8-inch; 3,350 ft. 6-inch c. i. pipe.
**Rutherford:** Vitrified pipe, 1 mile, 8-inch and 24-inch.

**South Orange:** Reinforced concrete, 500 lin. ft. 8-foot by 4-foot, storm sewer.
**Trenton:** (Sewer data later).
**Westfield:** Vitrified pipe, 2 miles.
**West New York:** Vitrified pipe, 2,000 ft. 12-inch.

### NEW MEXICO.

**Albuquerque:** Pipe laterals.

### NEW YORK.

**Binghamton:** Reinforced concrete, 2 miles 30-inch (under contract), lock joint.
Vitrified pipe, 4 miles, 8-inch to 18-inch.
**Cortland:** Vitrified pipe, 1 mile.
**Elmira:** Vitrified pipe, 3,000 ft.
**Ilion:** Treatment works, $35,000.
**Jamestown:** Expenditure of $25,000 proposed.
**Niagara Falls:** Reinforced concrete, 1 mile.
Vitrified pipe, 2 miles.
**Norwich:** Vitrified pipe, 3,500 ft. 8 and 10-inch.
Reinforcing, 1,800 ft. 8-inch cracked longitudinally along crown and sides.
**Ogdensburg:** No sewers ordered yet.
**Oswego:** Reinforced concrete, 5,700 ft. 5-foot to 6-foot.
Vitrified pipe, 23,000 ft. 8-inch to 39-inch.
Imhoff disposal tank.
**Rochester:** Sewage disposal plant will be let this year.
**Schenectady:** Reinforced concrete, 2 miles.
Vitrified pipe, 6 miles.
**Syracuse:** Vitrified pipe, 5 miles.
**Troy:** Brick, 1,500 ft. 36-inch by 48-inch.
Reinforced concrete, 1,900 ft., 8-foot.
Vitrified pipe, 10,000 ft. 8-inch to 24-inch.
**Watertown:** Reinforced concrete, 1 mile; contract let.
Vitrified pipe, 2 miles.

### NORTH CAROLINA.

**Greensboro:** Vitrified pipe, 6,000 ft.
**Rocky Mount:** Vitrified pipe, to cost about $40,000.
**Wilmington:** Vitrified pipe, 36 miles, sanitary, 8-inch to 24-inch; contract awarded.

### NORTH DAKOTA.

**Bismarck:** Vitrified pipe, 3,000 ft. 8-inch.
**Dickinson:** Short pipe laterals.
**Minot:** Vitrified pipe, 2 miles.
**Valley City:** Proposes to spend about $75,000 on sewers.
**Williston:** Vitrified pipe, 6,420 ft.

### OHIO.

**Barberton:** Vitrified pipe, 10 miles.
**Bowling Green:** Reinforced concrete, 2,000 ft. 40-inch.
Vitrified pipe, 8,000 ft. 18-inch; 2,000 ft. 10-inch; 1,000 ft. 8-inch.
**Cambridge:** Vitrified pipe, 7,000 ft. of 8, 10 and 12-inch, on concrete base.
**Canton:** Brick, ½ mile 7-foot, 2 ring block; 2 miles 36-inch 1 ring.
Vitrified pipe, 7 miles.
Sewage disposal, $150,000.
**Celina:** A complete sanitary sewer system will be sold as soon as proper legislation is passed; estimate, $80,000.
**Chillicothe:** Reinforced concrete, 3,280 lin. ft. 7-foot by 10-foot.
Vitrified pipe, 1,250 lin. ft.
**Conneaut:** Vitrified pipe, 4,500 lin. ft.
**Delaware:** Sewer mains, $15,000.
Sewage disposal, $25,000.
**Fostoria:** Vitrified pipe, 900 ft.
Sewage disposal plant.
**Lorain:** Vitrified pipe, 2 miles.
**Mansfield:** Sewer extensions, $20,000.
**Massillon:** 3,000 ft. storm, 2,000 ft. sanisewers.
**Newark:** Vitrified pipe, 14,000 lin. ft.
**Niles:** Vitrified pipe, 5,000 lin. ft. 6-inch to 10-inch.
**Oberlin:** Small pipe extensions.
**Ravenna:** Vitrified pipe, 5,280 ft.
Sanitary sewage disposal plant enlarged.
**Salem:** Storm sewer, 8,200 ft. long, 36-inch pipe to 5½ by 7 concrete box. Brick.
Vitrified pipe, about 1,000 ft.; sanitary sewers, 8-inch.
**Springfield:** Vitrified pipe, 3 miles 8-inch to 24-inch.
**Steubenville:** Vitrified pipe, 1 mile 12-inch to 15-inch.
**Tiffin:** Vitrified pipe, 550 ft.
**Warren:** Extensions, $10,000.
**Wellsville:** Vitrified pipe, 1,000 ft.
**Wooster:** Vitrified pipe, 20,000 lin. ft., 15, 12, 10, 8 and 6-inch.
**Zanesville:** Vitrified pipe, 5,000 ft. 12-inch; 4,000 ft. 18-inch.

### OKLAHOMA.

**Durant:** Small pipe branches.
**El Reno:** Sewer extensions, $20,000.
**McAlester:** Vitrified pipe, 700 ft. 6-inch.
**Okmulgee:** Sewer extensions.
**Tulsa:** Sewer system costing about $100,000.

### OREGON.

**Coquille:** Vitrified pipe, 39,000 lin. ft., 4, 6, 8, 10, 12-inch.
Brick manholes, flush tanks, concrete inverts.
**Eugene:** Plain or reinforced concrete, 16,000 lin. ft., 8 to 12-inch.
**Grant's Pass:** $15,000.

### PENNSYLVANIA.

**Athens:** Vitrified pipe, about 3,300 ft. 12-inch to 24-inch.
**Dravosburg:** Vitrified pipe, 800 lin. ft. 18-inch.
**DuBois:** Vitrified pipe, 3,000 ft. 8-inch. 2,000 ft. 15-inch.
**Erie:** Plain concrete, 2,000 ft. 40-inch.
Vitrified pipe, 13,000 ft. 9, 12 and 15-inch.
**Farrell:** Vitrified pipe, under consideration.
Engineer retained for sewage disposal plans.
**Hanover:** Reinforced concrete, 720 ft. 3-foot by 4-foot, rectangular.
Vitrified pipe, 2,200 lin. ft. 24-inch.
**Harrisburg:** Reinforced concrete, 21,300 ft.
Vitrified pipe, 21,300 ft.
**McKeesport:** Sewer extensions, $12,000.
**McKees Rocks:** Vitrified pipe, 2,500 ft. 8-inch to 15-inch.
**Meadville:** Small pipe laterals.
**Monongahela City:** Vitrified pipe, 2,900 lin. ft. 24-inch; 240 lin. ft. 18-inch; 1,200 lin. ft. 12-inch.
**New Brighton:** Vitrified pipe, 24-inch.
**New Castle:** Vitrified pipe, 1 mile small contracts.
**Northeast:** Sewage disposal, $10,000.
**Philadelphia:** Appropriations to the extent of $850,000 will be available; details of construction not determined as yet.
**Ridgway:** Vitrified pipe, 2,000 ft. 12-inch.
**Sayre:** Vitrified pipe, 2,000 ft. of 8-inch to 12-inch.
**Sharpsville:** Not determined.
**Swissvale:** Vitrified pipe, 1,300 lin. ft. 10-inch.
**Titusville:** Vitrified pipe, 1½ miles, small diameter.
**Wilkes-Barre:** Considerable additions to and changes in sewerage system, costing perhaps $100,000.
**York:** Brick, plain concrete, reinforced concrete or vitrified pipe, 10 miles.

### RHODE ISLAND.

Woonsocket: Vitrified pipe, about ½ mile.

### SOUTH DAKOTA.

**Aberdeen:** Sewage pumping and disposal plant, $35,000.
**Mitchell:** Short pipe laterals.
**Sioux Falls:** Vitrified pipe, 10 miles.

### TENNESSEE.

**Columbia:** Vitrified pipe, 1,700 ft.
**Jackson:** Brick, 98,000 ft.
Vitrified pipe, 23,000 lin. ft.
**Memphis:** Vitrified pipe, 10 miles.

### TEXAS.

**Bryan:** Branches.
**El Paso:** Sewer system under way, to cost about $150,000.
**Lufkin:** A fifty-year franchise granted to install a system of sanitary sewers 9 miles in length; sewage to be treated in septic tanks.
**Paris:** Vitrified pipe, 20,000 ft. 10-inch to 6-inch.
**Waxahachie:** Vitrified pipe, 2½ miles.

### UTAH.

**Ogden:** Plain concrete, 2,953 lin. ft.
Vitrified pipe, 7,529 lin. ft.
**Salt Lake City:** Vitrified pipe, 31,120 ft. 8-inch; 6,925 ft. 10-inch; 2,327 ft. 12-inch.

### VERMONT.

**Bellows Falls:** Plain concrete, 1,300 ft. 32-inch by 48-inch.
Vitrified pipe, 1,500 ft. 12-inch to 24-inch.

### VIRGINIA.

**Danville:** Vitrified pipe, 10,000 feet of 8-inch and 10-inch.

### WASHINGTON.

**Aberdeen:** Reinforced concrete, 1,460 ft. 42-inch; 728 ft. 36-inch; 1,700 ft. 33-inch; 1,085 ft. 30-inch.
Vitrified pipe or reinforced concrete, 20,000 ft. 6, 8, 10, 12 and 18-inch.
**Hoquiam:** Vitrified pipe, 18,000 ft. 6-inch; 12,000 ft. 8-inch; 2,000 ft. 10-inch; contract awarded.
**Seattle:** Reinforced concrete, 2,600 lin. ft.
Vitrified pipe, 200,000 lin. ft.
**Tacoma:** Sanitary and storm, $150,000.
**Walla Walla:** Vitrified pipe, 10,000 lin. ft. sizes.

### WEST VIRGINIA.

**Parkersburg:** Reinforced concrete, 6,000 ft.
Vitrified pipe, 4,000 ft.

### WISCONSIN.

**Baraboo:** Small branches only.
**Eau Claire:** Tenth Ward sewer, 4,300 ft.
800 ft. of 30 to 36-inch sewer.
1,400 ft. of 8 to 15-inch sewer.
**Kenosha:** Sewer extensions, $30,000.
**Madison:** Vitrified pipe, 25,000 ft. of all sizes.
**Marinette:** Brick, 1,000 lin. ft., 3-foot.
Vitrified pipe, 2,000 lin. ft.
**Oshkosh:** Reinforced concrete, 1,200 ft. 30-inch; 600 ft. 10-foot by 4.5-foot; cost $6,000.
Vitrified pipe, 2,700 ft. 27-inch, 15-inch, 12-inch.
Appropriation for new sewer construction, $20,470, and for catch-basins, $2,000.
**Sheboygan:** Vitrified pipe, 3,000 ft. 10-inch to 20-inch.
**Two Rivers:** Small pipe laterals.
**Waukesha:** Vitrified pipe, 9,000 ft.
**Waupaca:** Vitrified pipe, 4,000 ft. 8-inch and 18-inch.

### CANADA.

**Chatham, Ontario:** Vitrified pipe, 5,000 ft.
**Guelph, Ontario:** Vitrified pipe, 12,200 ft.
**Hamilton, Ontario:** Plain concrete, 1 mile 30-inch to 48-inch.
Vitrified pipe, 3 miles 12-inch to 24-inch.
**Lethbridge, Alberta:** Vitrified pipe, 1½ miles sanitary.
Concrete, brick or segment block, ½ mile storm.
**London, Ontario:** Not decided whether to adopt storm sewer system; if adopted will cost $89,000.
**Ottawa, Ontario:** Brick; two systems nearly completed now.
Vitrified pipe, 3 miles.
**Prince Rupert, B. C.:** Two outfalls and trunk sewer; estimated cost, $450,000.
**Regina, Sask.:** Vitrified pipe, 25 miles 8-inch to 48-inch.
**Vancouver, B. C.:** Not yet outlined.

### NOVA SCOTIA.

**Halifax:** Plain concrete, 1 mile of 48-inch; 1 mile of 18-inch to 24-inch.

## WATER WORKS IMPROVEMENTS FOR 1913

### ALABAMA.

**Dothan:** $70,000 combined water and power plant under construction.
**Gadsden:** Will spend $1,000 for meters.
**Troy:** Extensions of mains, $28,000.

### CALIFORNIA.

**Burlingame:** Election called for $175,000 bonds for water works.
**Gilroy:** Water works; new reservoir.
**Glendale:** Will vote on water works construction this spring.
**Huntington Beach:** City may purchase local water works.
**Imperial:** Two miles cast iron mains.
**Oxnard:** Have voted $130,000 bonds for water and light system.
**Pasadena:** Voted last year, $1,125,000 for water works.
**Redlands:** Has purchased water works and will make extensions.
**Santa Ana:** Begun on 8,500,000-gal. reservoir.
**Sierra Madre:** City is purchasing water company and contemplates improvements; expenditure, $171,000.
**Tulare:** Has just voted $100,000 bonds for water works.

### COLORADO.

**Grand Junction:** Short extensions of mains.

### CONNECTICUT.

**Southington:** Water works, 5,000 ft. to 10,000 ft. 2-inch mains.
**Torrington:** Water works; private concern will do a good deal of work.
**Wallingford:** Water works, 3,500 lin. ft. 6-inch to 8-inch.

### FLORIDA.

**Dade City:** Water works, $15,000 franchise contemplated.
**Sarasota:** $30,000 on plant and mains.

### GEORGIA.

**Americus:** Will buy some meters.
**Lagrange:** A new $150,000 plant.
**Moultrie:** Will buy a few meters.

### IDAHO.

**Weiser:** 500,000-gal. reinforced concrete reservoir.

### ILLINOIS.

**Assumption:** 60,000 ft. gal. pipe let and

under construction; distribution let and partly constructed.
**Bloomington:** Main extensions, $50,000.
**Canton:** Water works, 3,000 ft. 6-inch iron pipe; 2,500 ft. 4-inch cast iron pipe; fittings for 1½ million gal. pump.
**Chicago Heights:** Water works, 3,000 lin. ft. 14-inch main.
**Elgin:** Water works, stand pipe.
**Lake Forest:** Short extensions of mains.
**Mattoon:** 1 mile 6-inch water pipe.
**Moline:** $100,000 improvements.
**Normal:** Water works, cost $15,000, some small extensions.
**Oak Park, Village of:** Water works, 2¼ miles 6-inch and 8-inch water pipe; 404 lead water service pipes, ¾-inch diam.
**Quincy:** Water works, new filter plant.
**Rockford:** Water works, new mains $30,000.
**Rock Island:** Extensions, $70,000.
**Waukegan:** Extension of intake.
**Wood River:** Water works; 2,600 ft. of 6-inch main; 600 ft. of 8-inch main.

### INDIANA.

**Connersville:** New pumps are needed.
**Evansville:** Main extensions $40,000.
**Fort Wayne:** 2 miles, 4-inch to 8-inch.
**Huntington:** New wells and pump.
**Logansport:** Short extensions of mains.
**Plymouth:** Short branches.
**Portland:** Few extensions.

### IOWA.

**Cedar Falls:** Some short extensions of mains and additional meters.
**Dubuque:** Water works, $75,000; reservoir and new machinery.
**Independence:** 1 mile 6-inch mains.
**Indianola:** Small amount of work to be done.
**Marshalltown:** Water and sewer extensions, $25,000.
**Muscatine:** Extensions of mains, $35,000.
Reservoir work, $25,000.
**Nevada:** Water works, pump house and several blocks 6-inch mains.
**Oskaloosa:** Water works, 2 miles of service extensions.

### KANSAS.

**Belleville:** A little work only.
**Fort Scott:** A few main extensions and work on reservoir.
**Manhattan:** Extension of mains, $10,000.
A few additional meters.
**McPherson:** I new well and pump.
**Osawatomie:** Some meters and pumping station renewals.
**Salina:** Water works, may come up this year, but is not settled.
**Topeka:** Main extensions, $17,000.
New meters, $2,500.
Reservoir, $15,000.

### KENTUCKY.

**Ashland:** Water works, in court.
**Louisville:** Main extensions in progress, $300,000.
Pumping plant additions, $20,000.

### LOUISIANA.

**New Orleans:** Water works; small extensions to outlying sections.

### MAINE.

**Lewiston:** Water works, usual extension.
**Pittsfield:** Small extensions of mains.

### MARYLAND.

**Baltimore:** Reservoir construction amounting to $2,500,000 in progress.

### MASSACHUSETTS.

**Great Barrington:** Water works; the South Egremont Water Co., South Egremont, Mass., will, as soon as spring opens, build a concrete reservoir dam and lay about 19,000 ft. of cast iron water mains; bids are asked for.
**Lowell:** Extensions of mains, $50,000.
New meters, $10,000.
**Westfield:** Water works; preliminary work for large storage reservoir.

### MICHIGAN.

**Grand Rapids:** Extensions of mains, $35,000; new meters, $10,000.
**Granville:** Water works; may be some small extensions of water mains during summer.
**Hastings:** Two new 2,000,000 gal. pumps.
**Hillsdale:** Some extensions of mains.
**Holland:** Water works, under consideration.
**Saginaw:** Water works, new.

### MINNESOTA.

**Albert Lea:** Two miles 4-inch and 6-inch.
**Bemidji:** Some new construction, $7,000.
**Faribault:** Water works, 3,000,000-gallon reservoir; 3,000 ft. pipe.
**Fergus Falls:** Water works, 2,000 ft. 6-inch and 4-inch; 2,600 ft. 18-inch.
**Mankato:** Water works, light motor truck.
**Minneapolis:** Extensions of mains, $150,000.
**Monterideo:** Short extensions and a few meters.
**St. Paul:** Extensions, $500,000.
**South St. Paul:** Main extensions, $7,000.
**Stillwater:** Probably ½ to 1 mile.

### MISSISSIPPI.

**Port Gibson:** Small main extensions.
**Vicksburg:** Main extensions, $8,000.

### MISSOURI.

**Eldorado Springs:** Some main extensions, small.
**Fulton:** 2,000 ft. of 4-inch mains.
**Hannibal:** Water works, $200,000, private corporation.
**Kansas City:** Addition to distribution system, $300,000.
Additions to pumping plant, $125,000.
**Kirkville:** Will buy a few meters.
**Liberty:** Reservoir construction, $9,000.

### MONTANA.

**Bozeman:** A few extensions of mains.
**Great Falls:** Water works, $50,000.

### NEBRASKA.

**Lincoln:** Water works, 4½ miles.
**Norfolk:** New boilers and wells.
**Tecumseh:** A few main extensions.
**University Place:** Water works, new mains.

### NEW JERSEY.

**Bayonne:** New pipe, $10,000.
**Ocean City:** Water works, additions, 4,000 ft. cast iron mains.
**Rutherford:** Water works, stand pipe storage being agitated, for additional pressure.

### NEW YORK.

**Cortland:** Water works, new mains.
**Jamestown:** New mains, $150,000.
Meters, $10,000.
Additions to pumping plant, $50,000.
**Niagara Falls:** Main extensions, $25,000.
**Rochester:** Water works; ordinary amount of water pipe extension and some enlargements of existing mains, amounting to about $100,000.
**Syracuse:** New mains, $35,000.
Meters, etc., $20,000.
**Watertown:** Water works; dam and canal.

### NORTH CAROLINA.

**Greensboro:** Water works, $10,000.
**Raleigh:** Water works; city will vote on bond issue for $400,000 for plant.

**NORTH DAKOTA.**

**Bismarck:** Water works, private corporation.
**Dickinson:** A few main extensions.
**Minot:** Water works, 2 miles water mains.
**Valley City:** A few new mains and meters.
**Williston:** Water works, one 250,000 gal. stand pipe; 10,000 ft. cast iron pipe.

**OHIO.**

**Bowling Green:** A few new mains and meters.
**Cambridge:** Water works, extension water mains, estimate $5,000, 4-inch and 6-inch cast iron lines.
**Canton:** Main extensions, $58,000.
A few new meters.
**Fostoria:** Water works, one 100,000,000 gal. reservoir.
**Oberlin:** Small additions to mains and pumping plants.
**Ravenna:** Water works, 12 miles pipe.
**Steubenville:** Filtration plant.
**Zanesville:** New well system, $363,000.

**OKLAHOMA.**

**Chandler:** Small additions to mains and meters.
**Clinton:** Will purchase some meters.
**Durant:** Small main extensions.
**El Reno:** A few new mains and meters.
**Okmulgee:** Will spend about $20,000 on reservoir; new mains, meters, etc.
**Tulsa:** Main extensions and meters, $40,000.

**OREGON.**

**Coquille:** Relaying 4,000 ft. 4 and 6-in. pipe for 100 lbs. pressure.
**Eugene:** $100,000 in mains.
**McMinnville:** Some new mains.

**PENNSYLVANIA.**

**Dubois:** Will spend about $10,000 on main extensions, meters and reservoir.
**Farrell:** Water works, to be voted on April 8, 1913.
**Ridgway:** Water works, 4,000 ft. 8-inch water line.

**SOUTH CAROLINA.**

**Columbia:** Water works; contract awarded for coagulation basin, $30,000.

**SOUTH DAKOTA.**

**Aberdeen:** Pumping plant additions, $7,500.
**Mitchell:** Short main extensions.

**TENNESSEE.**

**Memphis:** Ordinary extensions.

**TEXAS.**

**Bryan:** A few additions to mains and meters.
**Paris:** Water works, 5 miles mains and new pump plant, cost $30,000.

**UTAH.**

**Ogden:** Will spend $100,000 on reservoirs and $25,000 on extensions of mains.

**WASHINGTON.**

**Aberdeen:** Five mi. wood stave pipe and dam.
**Grandview:** Water works; will complete a $16,000 system in March, 1913.
**Seattle:** 50,000 lin. ft. c. i. water mains.

**WISCONSIN.**

**Appleton:** Pumping plant, etc., $100,000.
**Baraboo:** A few main extensions and meters.
**Eau Claire:** 8,000 ft. of 6-inch main.
**Kenosha:** Extensions of mains, $15,000.
A few meters.
**Madison:** 15,000 ft. of new mains.
**Oshkosh:** Water works, city to buy.
**Sheboygan:** 3½ miles extension of mains.
**Waukesha:** New mains, $10,000 and a few meters.
**Waupaca:** 1,000 ft. small mains.

**CANADA.**

**Chatham, Ont.:** Extension to filters.
**Hamilton, Ont.:** Water works mains, 6 miles.
**Lethbridge, Alberta:** Water works, 5 miles metal pipe, 4-inch to 24-inch diam.
**Ottawa, Ont.:** Sedimentation basis for temporary supply; surveys going ahead for new supply from lakes.
**Prince Rupert, B. C.:** Water works and hydro-electric plant, $300,000.

**NOVA SCOTIA.**

**Halifax:** Water works, 3,000,000 gal. reinforced concrete reservoir, and 3 miles of distribution 12-inch to 20-inch.

# STREET LIGHTING FOR 1913

**CALIFORNIA.**

**Alhambra:** Six miles of ornamental lighting.
**Hanford:** Will vote $20,000 bonds for power system.
**Huntington Beach:** 35 new ornamental concrete 3-light posts just put in; more to follow.
Making plans for gas plant to build this year.
**Oxnard:** Has voted $130,000 bonds for water and light system.
**Palo Alto:** Small improvements.
**Pasadena:** Ornamental lighting, 6 miles.

**CONNECTICUT.**

**Torrington:** Business section will have better lights.

**DISTRICT OF COLUMBIA.**

**Washington:** Lighting, $391,000.

**FLORIDA.**

**Dade City,** Lighting installed.

**ILLINOIS.**

**Centralia:** Lighting; possibly ornamental on 7 blocks.
**DeKalb:** Lighting, 6 blocks White Way.

**INDIANA.**

**Anderson:** 2,000-kilowatt generator.
**Fort Wayne:** Lighting; one mile of street with ornamental lamp posts.
**Huntington:** Lighting; new dynamo
**Richmond:** Lighting; addition to power house and new unit installed.

**IOWA.**

**Dubuque:** Lighting; $285,000.
**Independence:** Lighting, not known.

**KANSAS.**

**Paola:** $45,000 plant.
**Pittsburg:** Lighting, 5 blocks White Way.
**Wichita:** Lighting, 1 mile White Way.

**KENTUCKY.**

**Ashland:** Lighting; Ohio Valley Elec. Co. will probably renew franchise.

**MASSACHUSETTS.**

**Southbridge:** Lighting, ornamental.

**MICHIGAN.**

**Hastings:** 500-kilowatt lighting plant.
**Holland:** Lighting, under consideration.
**Saginaw:** Lighting; new system.

**MISSOURI.**

**Kansas City:** Lighting; municipal electric plant talked of, but no bonds voted yet; up for consideration this spring.
**Sedalia:** Lighting and gas, $150,000; betterments.
**Webb City:** Lighting; to improve system.

**MONTANA.**

**Great Falls:** Lighting, $15,000.
**Helena:** 500 single lamp posts.
137 5-lamp posts in business district.

**NEBRASKA.**

**University Place:** Lighting; new plant.

**NEW JERSEY.**

**Ocean City:** Lighting; new system for boardwalk.
**Plainfield:** Lighting; improvements planned.

**NEW YORK.**

**Binghamton:** Lighting; new municipal electric light plant, cost $158,000, street lighting only; 300 k. w. extension of boulevard lighting system to cost $74,000.
**Ilion:** Lighting; $25,000 for new unit to be submitted to taxpayers March 4.
**Niagara Falls:** Lighting; $30,000 on decorative street illumination.
**Troy:** Lighting; Tungsten lighting system, 306 standards, 1 upright, 4 pendants.

**NORTH CAROLINA.**

**Rocky Mount:** Municipal gas works to cost $70,000.

**NORTH DAKOTA.**

**Minot:** Lighting; ornamental lighting system, 10 blocks.
**Williston:** Lighting; 56 White posts.

**OHIO.**

**Barberton:** Lighting plant.
**Bryan:** Lighting; arrangements will be made soon for advertising for a system of fine light ornamental standard lighting system for court square and the business section of our city; about 70 ornamental posts will be needed.
**Toledo:** Lighting; city is looking forward to municipal ownership of Toledo, Railway and Light companies. It includes a street railway, lighting system, heating and amusement properties.
**Wellsville:** Lighting; municipal light plant.

**OREGON.**

**Eugene:** Some cluster lights.

**PENNSYLVANIA.**

**Dravosburg:** New 5-year contract.
**Farrell:** Lighting; under consideration.
**Titusville:** Installing new generators now.

**TENNESSEE.**

**Jackson:** Lighting; Great White Way.
**Memphis:** Lighting; ordinary extensions.

**TEXAS.**

**Paris:** Lighting; 20 additional arcs.
**Waxahachie:** Lighting; whole town.

**WEST VIRGINIA.**

**Parkersburg:** Lighting; contracted for.

**WISCONSIN.**

**Eau Claire:** Lighting; system remodeled and White Way on Main street.

**CANADA.**

**Chatham, Ontario:** Extension to street lighting.
**Hamilton, Ontario:** Complete new system.
**London, Ontario:** Lighting, 300 additional.
**Prince Rupert, B. C.:** Hydro-electric plant and water works, $300,000.

# BRIDGES AND BUILDINGS FOR 1913

**ALABAMA.**

**Gadsden:** Three bridges.
**Jasper:** One bridge probably.

**CALIFORNIA.**

**Alhambra:** 2 bridges, approximate cost, $4,000.
City hall bonds voted, $50,000.
Library bonds voted, $50,000.
Bridge bonds voted, $32,000.
**Huntington Beach:** 1,300 ft. concrete wharf; bids to be opened in March; $65,000.
**San Bernardino:** Contemplating $75,000 city hall.
**San Francisco:** Raising $800,000 for municipal auditorium.
City hall, $4,000,000.
Public library building, $1,000,000.
**Santa Ana:** Technical high school, $225,000 bonds voted.
**Santa Barbara:** Contract let, $35,000.
**Vallejo:** City hall, $75,000.

**CONNECTICUT.**

**Middletown:** One span about 80 ft.
**Southington:** One iron bridge with reinforced concrete floor.
**Torrington:** Two steel bridges.

**DISTRICT OF COLUMBIA.**

**Washington:** Bridges to cost $435,000.

**ILLINOIS.**

**Dixon:** Bridges and culverts, 1,500 cu. yds. concrete.
**Edwardsville:** One bridge.
**Lake Forest:** One concrete bridge.
**Moline:** Concrete bridge, 100 ft. span.
**Rockford:** One concrete bridge, $2,200.
One concrete bridge, $2,700.
**Streator:** One bridge to be repaired (concrete to be used).
**Waukegan:** Reinforced concrete arch, $70,000.

**INDIANA.**

**Connersville:** 7 bridges, $6,500.
**Covington:** Four small bridges.
**Crawfordsville:** Repair 2 bridges, concrete floors.
**Hartford City:** 7 concrete bridges.

**IOWA.**

**Clinton:** Concrete bridge, $2,000.
**Marshalltown:** County concrete bridges, $25,000.

### KANSAS.

**Newton:** One concrete bridge, cost $6,000.
**Paola:** 3 concrete culverts.
**Pittsburg:** Three concrete bridges; total, $3,000.
**Salina:** Cement bridge.

### MASSACHUSETTS.

**Southbridge:** Three cement concrete girders.

### MICHIGAN.

**Granville:** Nothing except replacing bridges.
Building an expensive school house.
**Hillsdale:** One small cement bridge.
**Saginaw:** Market house.

### MINNESOTA.

**Albert Lea:** One 60-foot steel bridge.
**Faribault:** One viaduct 988 ft., steel.
**Minneapolis:** Two bridges across Mississippi river.
**Montevideo:** 60 ft. concrete bridge and spillway, and 100 ft. timber foot bridge.
**Stillwater:** One bridge; type not decided.
**Winona:** 30 ft. concrete girder.

### MISSOURI.

**Fulton:** $3,500 reinforced concrete 65-foot arch, 26 feet wide.
**Jefferson City:** Two concrete bridges; one concrete tunnel.
**Kansas City:** Twelfth street trafficway (reinforced concrete), $650,000.
**Springfield:** Concrete waterways, about $7,000.

### MONTANA.

**Great Falls:** Concrete arch 1,000 ft. long.

### NEW JERSEY.

**Ocean City:** One bridge, $192,000.

### NEW YORK.

**Binghamton:** One 60-foot span, reinforced concrete.
New high school, $375,000.
**Cortland:** One bridge.
**Elmira:** One small reinforced concrete bridge; reinforced concrete retaining wall for 2 approaches.
**Ilion:** High school building, $100,000 (advertised).
**Rochester:** Reinforced conduit to carry waters of Canadice lake into Hemlock lake.
**Syracuse:** Three bridges.
**Watertown:** Bridge 1,000 ft. long to be voted on about June 1.

### NORTH DAKOTA.

**Minot:** Two-foot bridges; one highway bridge.

### OHIO.

**Canton:** One stone arch; one steel arch.
**Conneaut:** One bridge, street railway and highway.
**Massillon:** One 2-span river bridge.
One 1-span canal bridge.
**Niles:** One bridge.
**Steubenville:** One bridge.

### OKLAHOMA.

**McAlester:** One reinforced concrete bridge.

### OREGON.

**Coquille:** 1,300 lin. ft. 24-foot elevated roadway on pile footings.
1,200 lin. ft. reinforced concrete elevated roadways to replace old structures 60 ft. wide, 10 to 22 ft. high. Information wanted on materials for reinforcement of concrete roadway, slab system.

### PENNSYLVANIA.

**Athens:** Bridge over Susquehanna river by Bradford Co. to replace old one, estimated about $60,000.
**Catasauqua:** Two reinforced concrete bridges.
**DuBois:** Bridges, 80-foot span and 20-foot span.
**Eugene:** Two concrete bridges, 60-ft. span, 66 ft. wide.
**Farrell:** One bridge.
**Philadelphia:** Bridges; $200,000 appropriation; details not determined as yet.
**Ridgway:** Reinforced concrete bridge, 70-foot span, 20-foot roadway, with two 5½-foot walks; contract let; $7,000.
**Titusville:** One small concrete bridge.
**York:** One 150-foot span, reinforced concrete.

### RHODE ISLAND.

**East Providence:** Re-planking Washington bridge, 500 ft.
**Woonsocket:** One arch 60-foot span, 32-foot roadway, 50 feet wide over all.

### TENNESSEE.

**Memphis:** Chicago and Rock Island Railroad, wagon and street railway bridge, over Mississippi river.

### UTAH.

**Ogden:** One steel bridge.

### VIRGINIA.

**Danville:** Appropriations not yet made.
**Newport News:** Repairs, about $4,000, to be done by county, railway and city jointly with own forces.

### WASHINGTON.

**Aberdeen:** Single-leaf steel bascule bridge.

### WISCONSIN.

**Eau Claire:** Bridges; reinforced concrete arch bridge about 700 ft. long.
**Madison:** One reinforced arch.
**Oshkosh:** The following appropriations made for public improvements:
$3,500 for concrete bathing pavilion at Menominee Park.
$500 for laboratory for city health department.
$650 for branch library on south side.
$2,200 for industrial and continuation schools.
$400 for repairing bridge in Menominee park.
$400 for display fountain in Riverside park.
$1,200 to construct dock at foot of Court street, and $750 for dock at foot of Nebraska street.
Bridge at West Algoma street, $186,-612.82. Contract let.
**Sheboygan:** One 2-span highway, $20,000.

### CANADA.

**Chatham, Ontario:** Three bridges.
**Guelph, Ontario:** Hefferman street bridge, 518 ft. long.
Victoria bridge, 200 ft. long.
**Hamilton, Ontario:** 3 steel trestles; 2 wooden trestles.
**London, Ontario:** 1 highway bridge, 3 130-ft. spans over River Thames.
**Ottawa, Ontario:** Bronson avenue viaduct (steel).
Pretoria avenue bridge (reinforced concrete).
**Regina, Sask.:** Bridges, $35,000.

# MISCELLANEOUS IMPROVEMENTS FOR 1913

## Garbage Disposal

**CALIFORNIA.**

**Alhambra:** $10,000 voted for incinerator.
**Berkeley:** Plans ready for incineration plant.
**Pasadena:** Incinerator under construction.

**CANADA.**

**Chatham, Ontario:** Commencing regular collection.
**Hamilton, Ontario:** $46,000.
**London, Ontario:** Incinerator, 50 tons per day, being erected.
**Ottawa, Ontario:** New system, city takes over all equipment, $130,000 to be spent.

**DISTRICT OF COLUMBIA.**

**Washington:** $180,000.

**ILLINOIS.**

**Chicago Heights:** Incinerating plant.

**IOWA.**

**Dubuque:** $6,000.
**Oskaloosa:** Garbage to be collected this year.
**Toledo:** Outlet and disposal plant, cost $7,000. Bids called for March 10.

**KANSAS.**

**Arkansas City:** Contract to be let for garbage in few days.

**MASSACHUSETTS.**

**Southbridge:** Garbage collection, yes.

**MICHIGAN.**

**Highland Park:** Under consideration.

**MINNESOTA.**

**St. Paul:** Incinerator to be built, $200,000.

**MISSOURI.**

**Hannibal:** $6,000.
**Kansas City:** One destructor to be built, cost $50,000.

**MONTANA.**

**Great Falls:** 11,000 loads.

**NEBRASKA.**

**Lincoln:** Plant contemplated.

**NEW JERSEY.**

**Plainfield:** Talked of.

**NEW YORK.**

**Schenectady:** One plant.

**NORTH CAROLINA.**

**Wilmington:** Decarie incinerator, 40 tons' capacity.

**OHIO.**

**Ravenna:** Possible collection and disposal contract for 5 years.
**Massillon:** Wanted.

**OREGON.**

**Coquille:** Information wanted about installing municipal plant.

**PENNSYLVANIA.**

**Dravosburg:** In prospect.
**Erie:** $35,000.

**TENNESSEE.**

**Memphis:** About 100 tons per day.

**WASHINGTON.**

**Aberdeen:** Let by contract.

**WEST VIRGINIA.**

**Parkersburg:** Contracted for.

## Street Signs

**CALIFORNIA.**

**Lodi:** About 300.

**FLORIDA.**

**Dade City:** 200 contemplated.

**ILLINOIS.**

**Quincy:** Perhaps 1,600.

**INDIANA.**

**Huntington:** Some.
**Nevada:** In preparation for establishment of free delivery of mail.

**MASSACHUSETTS.**

**Westfield:** About 30 new signs.

**MICHIGAN.**

**Highland Park:** Under consideration.

**NEW JERSEY.**

**Ocean City:** Few wanted.
**Plainfield:** All ordered, 125.

**NORTH DAKOTA.**

**Minot:** 500.

**OHIO.**

**Massillon:** Repair.
**Ravenna:** 300 double signs.

**PENNSYLVANIA.**

**Harrisburg:** 3,900.

**WASHINGTON.**

**Aberdeen:** 3,000.

**CANADA.**

**Lethbridge, Alberta:** $300.

## Fire Departments

**ALABAMA.**

**Dothan:** $9,000 auto fire truck and engine.

**CALIFORNIA.**

**Alhambra:** $31,000.
**Berkeley:** Asked bids for $5,000 extension to police signal and alarm system.
**Gilroy:** New chemical motor.
**Huntington Beach:** New combination auto chemical and hose cart.
**Lodi:** One combination auto truck.
**Palo Alto:** Small improvements.
**Tulare:** Just voted $8,000 for new fire apparatus and $2,000 for fire alarm system.
**Vallejo:** $35,000.

**CONNECTICUT.**

**Ansonia:** New alarm system.

**ILLINOIS.**

**Canton:** Purchase of motor truck.
**Chicago Heights:** Hook and ladder equipment and hose.

**INDIANA.**

**Anderson:** 1 ladder truck; 1 auto chemical for chief.
**Bloomington:** Fire department and city building, $25,000.
**Fort Wayne:** Motor equipment one department.
**Huntington:** New central station.
**Indianapolis:** New fire department headquarters building.

**IOWA.**

**Dubuque:** Auto pumping engine, $10,000.
**Marshalltown:** New fire station, $6,000.
**Nevada:** Some new hose.
**Webster City:** Just completed.

**MASSACHUSETTS.**

**Westfield:** New motor driven apparatus.

**MICHIGAN.**

**Highland Park:** Under consideration.
**Holland:** Under consideration.

**MINNESOTA.**

**Albert Lea:** Auto truck.
**Mankato:** Engine.

**MISSOURI.**

**Columbia:** A new auto fire wagon has been ordered.
**Hannibal:** $1,000.

**MONTANA.**

**Great Falls:** Fire and police departments; $50,000 new building.
**Helena:** New auto truck.

**NEBRASKA.**

**Norfolk:** 1,000 ft. of hose.
**University Place:** City hall, fire hose and chemical extinguisher.

**NEW HAMPSHIRE.**

**Littleton:** 1,000 ft. of hose.

**NEW JERSEY.**

**Beach Haven:** $5,000 fire house, new equipment and alarm system.
**Ocean City:** 1 steam fire engine and 1 aerial truck; 1 auto chemical.
**Rutherford:** Auto apparatus being agitated.
**West New York:** 1 new auto truck, aerial; 3 new fire houses.

**NEW YORK.**

**Binghamton:** 1 new motor apparatus (under contract).
**Ilion:** $5,000 auto chemical and hose truck; to be submitted to the taxpayers March 4.
**Troy:** Fire alarm telegraph and police patrol system; Gamewell system.

**NORTH DAKOTA.**

**Minot:** Motor truck.

**OHIO.**

**Steubenville:** Motor truck; new hose.
**Wellsville:** Motor fire truck a possibility.

**PENNSYLVANIA.**

**Monongahela:** 1,000 ft. of hose.
**Swissvale:** 500 ft. hose.

**TEXAS.**

**Paris:** Chief's car and 1 hook and ladder.

**VERMONT.**

**Bellows Falls:** 1,000 ft. hose.

**VIRGINIA.**

**Newport News:** Construction tractor hose wagon and chemical extinguisher.

**WASHINGTON.**

**Aberdeen:** One auto engine, 1 auto hook and ladder, 1 auto hose cart.

**WISCONSIN.**

**Eau Claire:** New Chief's auto.
**Madison:** One new truck.
**Oshkosh:** An appropriation of $3,500 to purchase auto hose wagon.

**CANADA.**

**Hamilton, Ont.:** $25,000.
**Prince Rupert, B. C.:** Fire department additions, $10,000.

## Police Departments

**CONNECTICUT.**

**Ansonia:** New alarm system.

**ILLINOIS.**

**Joliet:** Chief asks for appropriation for motor ambulance and patrol wagon.
**Quincy:** New electric signal system.
**Rockford:** Motor patrol.

**INDIANA.**

**Fort Wayne:** 2 miles of cable.

**IOWA.**

**Dubuque:** New patrol auto $3,000.

**KANSAS.**

**Chanute:** Proposed second story addition to jail, about $1,000.

**MASSACHUSETTS.**

**Westfield:** Signal system and new patrol wagon.

**MICHIGAN.**

**Holland:** Under consideration.

**MONTANA.**

**Great Falls:** Police and fire department, $5,000 new building.

**NEW YORK.**

**Troy:** Police patrol system; Gamewell system.

**OHIO.**

**Zanesville:** One motorcycle; one auto patrol.

**WASHINGTON.**

**Aberdeen:** One auto patrol.

**WISCONSIN.**

**Madison:** 1 new patrol.

# QUESTION DEPARTMENT

## Purification of Sewage in Long Sewers

I wish you would state in your question department if you know of any work or article on the purification of sewage by flowing thru long pipes or sewers. tI is known that sewage is broken up and purification does take place in flowing in long channels, but I have not been able to get any definite data on this subject P., C., ———, Ill.

Some books on sewerage and sewage disposal mention the fact that some decomposition of sewage takes place during the flow thru a long sewer, but the amount is so slight and the possibility of getting rid of the products of decomposition and thus actually purifying the sewage is so remote that no account is taken of what takes place. Indeed, for some of the methods of purification in use the decomposition which takes place in the sewer is troublesome, because it admits an element of uncertainty and the action in the purifications tanks cannot be so definitely predicted. In general, it may be said that the flow of undiluted sewage in any channel of probable or reasonable length gives it little opportunity for purification of the sewage, and if the channel is covered, as in a pipe or sewer, the condition is less favorable because of lack of sunlight and free air, and the confinement of the gases of decomposition produces an additional source of nuisance and difficulty.

There may be some apparent improvement in the liquid on account of disintegration of solids, which would not be equally evident in chemical and biological analyses.

Can our reads cite any instances of the sort named by our correspondent?

## Disposal of Snow From Street Railway Tracks

I would like to receive such information as you may be able to furnish relative to ordinances intended to impose upon street car companies the cost of removing snow accumulations caused by their snow plows on either side of the car tracks.

E., City Solicitor, ———, Pa.

The question of the distribution of the expense of removing snow from streets between the city and the street railway company was discussed at some length in MUNICIPAL ENGINEERING, vol. xl, p. 34, and this article may contain the information desired. It refers to the methods in use in several cities. Quotations from street railway franchises and ordinances in Elgin and Moline, lll.; Dayton, O.; Rome, N. Y., are given, and also full descriptions of methods of taking care of the snow.

## Building Ordinance for Small City

A quite recent disastrous fire in the business portion of this town (3,000 pop.), largely helped along by inferior materials and construction of some of the business houses, has called the attention of the board of aldermen of the city to the necessity for stricter regulations of the materials and construction of such houses. Our statute (charter) gives the city ample powers in the premises, and I am seeking, at the request of the city council, suggestions and forms of ordinances applicable in such cases.

The city and myself will greatly appreciate it if you will publish in MUNICIPAL ENGINEERING, if not too long, or tell me where I may find an approved form of ordinance relating to this matter.

R. N. BANISTER, City Attorney,
Eldorado Springs, Mo.

A building ordinance will cover the case. The Indianapolis ordinance, which can be obtained of the building inspector, in the City Hall, is a booklet of perhaps 150 pages. Cleveland has a very excellent building ordinance, which can be obtained from the city attorney or the building inspector. MUNICIPAL ENGINEERING has published two articles on the subject of the removal of old buildings within fire limits and ordinances governing the same in vol. xxxvii, p. 184, giving the sections of the ordinances in Cincinnati and Dubuque governing this matter, and in vol. xxxviii, p. 271, which gives

the provisions in Atlanta. These ordinances are, doubtless, more extensive than would be necessary in a small city. The discussions in the articles referred to will be of interest, especially since the right of a city to remove old buildings within fire limits established after these buildings were constructed has not yet been definitely settled by the courts.

## Ordinance Requiring Ornamental Trolley Poles

The common council of this city is desirous of passing an ordinance providing for the installation of ornamental iron trolley poles in certain districts of the city. May I impose upon your service for reference to ordinances covering the subject matter of my inquiry?

I wish to express my satisfaction with the results which I have been deriving from the examination of your magazine since I have been a subscriber.

R. K. P., City Attorney, ———, Ore.

Can our readers supply our correspondent with copies of such ordinances as he desires? Most street railway contracts are in such form that a special agreement must be made to cover such changes as that desired and a special ordinance or contract must be drawn to cover the particular case. No ordinance compelling the street railway company to use the ornamental poles is on file. In some cases the matter could be taken care of under the common provision in street railway franchises that the character of poles used must be satisfactory to the city authorities, which is supplemented in some cases by a provision that the city can order changes. Unless clearly stated in the franchise, however, it is hardly probable that the city could by ordinance force the company to expend money simply for ornamentation for poles or to substitute ornamental poles for poles otherwise satisfactory and not objectionably ugly, which have already been approved. A mutual agreement would seem to be necessary.

A change from wood to iron could be required on other grounds, and may give an opportunity to obtain part, at least, of what is desired.

## Specifications for Asphaltic Concrete

I notice in your November issue an article entitled "Preparing Asphaltic Concrete," by H. S. Rogers of Chicago. Where could I get the specifications under which this work is done.

W. I. THOMPSON,
Henderson, Ky.

The specifications used in laying the asphaltic concrete described in the article referred to are those used by the South Park Board of Chicago, of which Mr. Linn White is the chief engineer.

## Electric Light Franchise

I have before me the duty of drawing a franchise for furnishing electricity for heat, light and power, and would be glad to have any information or suggestions from your information department relative to proper provisions for the protection of the interests of the city and the public in the premises.

R., City Attorney, ———, Okla.

A form of franchise will be found in MUNICIPAL ENGINEERING, vol. xliii, p. 322.

## Ordinance Regulating Peddling

In your suggested ordinance, on page 178 of your September number, regulating peddling, I notice you include in Section 1, "Any person going about said city on foot or otherwise, taking orders for or selling any kind of goods, wares or merchandise by sample, to be afterwards delivered." Assuming that this suggestion is supported by court decisions distinguishing in some way such provision from the interstate commerce clause of the constitution, I write to ask if you can refer to the court decisions so holding. Your suggested ordinance providing that this provision shall not apply to drummers selling goods by sample to resident merchants, recognizes that this last proviso does come within the interstate commerce clause and that cities could not pass an ordinance taxing such business.

It has become a custom in many cities for houses to have agents going from house to house, taking orders by samples of various lines of merchandise. It ought to be regulated, but whether it can or not is the question I would like to know more about by reference to the decisions so distinguishing.

P., Mayor, ———, Kans.

The question raised is one which does not seem to have been settled. There are decisions that a drummer is not a peddler, as in Kansas City vs. Collins, 34th Kansas 434, but that a man selling by sample may be a peddler if he is so defined in the statutes or ordinances governing the matter, such as Newcastle vs. Cutler, 15th Pennsylvania Superior Court 612, and Spanish Fork vs. Mortenson, 7 Utah 33. A clear distinction between mercantile agent, drummer and peddler is made in Brookfield vs. Kitchen, 163 Missouri 546. A drummer sells to merchants, and the mercantile agent sells to the consumers, and the difference in their treatment seems to be based on this difference in fact.

Can our readers give references to decisions on the subject or to ordinances which are practically in control of the matter?

## Prices for City Lot Surveys

Can you refer me to article in MUNICIPAL ENGINEERING concerning city lot surveys, etc., prices charged and ordinances governing such work where it is done by the city engineering department?

W., Port Huron, Mich.

In MUNICIPAL ENGINEERING, vol. xlii, p. 470, will be found a descriptive list of

articles on "Cost of City Engineering and Fees for Municipal Engineering Services." The only article there listed which seems to touch the point in the question closely is one on "Lot Surveys by the City Engineer," in vol. xxxiv, p. 365, which gives a schedule of fees and some suggestions as to provisions of an ordinance, which are subject to modification according to local customs and state laws.

## Record of Meter Readings

We are endeavoring to secure a book for keeping records of meter readings and numbers and have been referred to you. If you have anything to offer in this line we would appreciate your kindness in sending us a sample page, or giving us full description of same.

P., Pittsburg, Pa.

The American Water Works Bookkeeping System does not include a meter reading book. The most convenient is one with removable leaves, of pocket size. It is printed in columns, one for the date, month and day; one for the meter readings, one for the difference of meter readings, or amount consumed and one for the amount reduced to the unit in which water is billed.

At the top of each page is the house number and other description of property or person served by the meter, the name of the person, the numberr of his account on the books, or other method of identifying or indexing it, the number of the meter and its description.

Some superintendents prefer to have in the meter reading book only the first three columns named and but one identification of the account, keeping all the other information on cards or in record books such as the cards and metered water register of the American Water Works Bookkeeping System, copying the readings from the meter into the account books each month or each quarter as they are made.

The sheets being removable, when an account is closed or a sheet is filled it can be removed and filed where it belongs or destroyed and a new sheet inserted for new account at the same place, or continuance of the old account. The sheets in the meter reader's book are arranged in the order most convenient for him in reading the meters, and the method of identification of accounts used should be that which will make it easiest to find the accounts when the readings are transferred to them.

An elaborate form of meter reading record used in Jamestown, N. Y., will be found in MUNICIPAL ENGINEERING, vol. xlii, p. 121. Some modifications are suggested in connection with it and others will readily suggest themselves.

Will our readers send samples of the sheets they use in their meter reading books, filled out to show the method of using them?

## Ordinance Fixing Quality and Rates for Gas

Can you furnish us with a form of ordinance fixing the rate and quality of gas for the consumers of a city of 6,000, with a daily gas consumption of one hundred thousand feet? What rate per thousand feet is a reasonable rate under the above circumstances?

C., City Attorney, ———, Mich.

A full form for a gas franchise ordinance is given in MUNICIPAL ENGINEERING, vol. xlii, p. 185. It covers all the points usually included in a gas franchise, but the quality. Small plants generally use the oil or water-gas methods of making gas and can supply 18-candle-power gas without difficulty. Since the advent of incandescent mantles there has been a tendency to fix the standard of quality at 600 or 650 heat units per cubic foot of gas at atmospheric pressure. The former is about all that a water-gas plant can reach economically.

The rates fixed under the ordinance referred to by an expert commission were $2 per 1,000 cubic feet for the first 500 cubic feet or less, reducing by stages for larger consumption to $1.25 per 1,000 for all over 10,000 cubic feet.

## How to Build Residential Sewage Disposal Plant

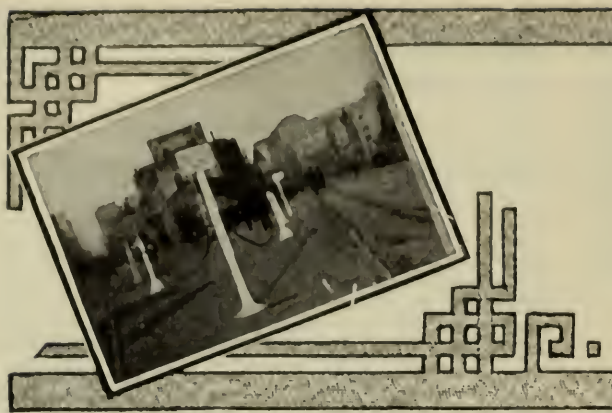
In MUNICIPAL ENGINEERING, vol. xxxvi, April, 1909, page 242, you cite "How to Build Residential Sewage Disposal Plant," vol. xxxv, 244. Would this furnish sufficient instructions for the construction of such an affair, for the use in a one-story 5-room dwelling, accommodating not more than four persons regularly? I desire to dispose of kitchen sink and bath room products, both if may be, but in any case of that from the water closet. Would this plan be expensive or about how expensive in my case?

M., Palestine, Ill.

The number referred to gives good general specifications for the construction of two designs of settling basins for disposal of sewage from a single house.

In vol. xlii, p. 229, is a set of plans for a residential sewage disposal plant, including septic tank and dosing chamber, intermittent sand filter underground, and a sub-surface absorption system with underdrains, from which one can select what is most nearly applicable to his case. The exact dimensions are not given in order that they may be determined to suit the particular case.

Other articles of interest, not mentioned in the articles referred to in the question, are "The Russell Sewage Disposal System," vol. xlii, p. 347, and "Disposal of Single House Sewage," vol. xli, p. 42.



# WORKERS IN THE FIELD

## William C. Perkins

*Assumes Important Position.*

One of the most important advances in the brick paving industry has developed during the past month. When the Dunn Wire-Cut-Lug Brick Co. placed its new form of brick on the market it realized keenly that, regardless of how good its product might be, unless engineers were familiar with its character and contractors thoroly versed in its use, but a small portion of its value would be utilized. Early in its history this organization appreciated that the most effective help could only be given thru the services of an efficiently organized department of engineers of unquestioned ability and standing in their profession. After several years an inspection and service department is now being organized with an engineer in charge whose services will be of great value to engineers and contractors over the entire country.

The person in charge will be W. C. Perkins, C. E., Mem. Am. Soc. C. E., acting as supervising engineer.

Mr. Perkins has been identified with the good roads movement, as one of its leading highway engineers for many years. For seven years he was in the employ of the city of Philadelphia as superintendent of construction of the Fairmount Park boulevards, walks and bridle paths. While engaged in that work he laid and supervised the construction of a large number of the wonderful highways for which this park system is famous.

Later he was connected with the New York State highway department, and held the position of resident engineer in charge of the Niagara and Orleans counties highways, with headquarters in Niagara Falls. From this position he has just received a leave of absence from state work. By securing this privilege Mr. Perkins retains his standing in the state civil service, in which he has a very high rating as an engineer.

While acting in the above capacity he has laid many miles of roads with wire-cut-lug brick, and has made a very careful study of brick highways in general.

Appreciation of his work and the high regard in which it is held by the people of the counties he has served has been expressed by the Niagara Falls Gazette as follows:

"The service given the state by Mr. Perkins as resident engineer here for the last two years, during which he had charge of the work of building the Niagara county and the Buffalo-Niagara Falls boulevard, and its extension to Youngstown, as well as the Ridge road trunk state highway, has been of such splendid nature that his leaving is a cause of greatest regret among the friends of good roads in this end of the state. He has been with the state highway department since 1906, during which all of his activities have been in this section.

"All of the Niagara county good roads have been constructed under his charge. That he, as a Republican, was appointed resident engineer under a Democratic state administration and has continued in such appointment until his voluntary leaving is an evidence of the superior service he has given in such capacity."

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## Creosoted Wood Block in Detroit

The Editor of MUNICIPAL ENGINEERING:

Sir—In the year 1905, the city laid its first street of creosoted long leaf yellow pine. This was on Catherine street, from Chene to Jos. Campau, 2,062.23 square yards. The following year Belle Isle bridge was paved with the same material, taking some 6,700 yards. This bridge is the only traffic connection between the city and Belle Isle park. The traffic, especially in the summer time, is enormous. Up to the present date no money has been expended upon the maintenance of this roadway.

In 1907 six streets were paved, taking in all, approximately 25,000 yards.

In 1908 ten more streets were paved, with a total of 29,500 yards.

In 1909 seven streets, with a total of 21,356 square yards.

CREOSOTED WOOD *Block Pavement on Griswold Street, Detroit, Mich.*

In 1910 eight streets, totaling 28,408 square yards.

In 1911 eleven streets, with a total of 48,229 square yards.

In 1912 twenty-nine streets, with an approximate total of 158,500 square yards. The total amount laid and in the process of construction at this time is 319,820 square yards.

The only appropriation asked for maintenance on this work was $500.00 allowed in 1912.

In 1907 the specifications called for 3-inch long leaf yellow pine block, with a treatment of sixteen pounds of creosote oil to the cubic foot. In 1908 this was changed to a 4-inch, 16-pound block, and in 1909 it was again changed to a 3½-inch, 20-pound treatment, which specifications have been in vogue with perfect satisfaction since that time.

The accompanying table gives a list of streets already paved, and to be paved, with creosoted wood block, totalling nineteen miles.

CREOSOTED WOOD BLOCK STREETS IN DETROIT.

| Street | Length ft. | Sq. Yards |
|---|---|---|
| Avery | 4,190.60 | 14,905.81 |
| Burroughs | 925.90 | 2,782.69 |
| Bagg | 357.60 | 950.29 |
| Brady | 1,618.30 | 4,960.88 |
| Brooklyn | 5,067.10 | 15,934.57 |
| Burns | 986.00 | 3,171.57 |
| Belle Isle Bridge | 2,636.00 | 6,761.00 |
| Clinton (Kreodone) | 1,077.50 | 2,924.48 |
| Catherine (Kreodone) | 871.60 | 2,062.23 |
| Cass | 546.00 | 1,872.93 |
| Cherry | 954.20 | 2,978.77 |
| Champlain | 2,077.20 | 5,482.73 |
| Edison | 1,756.38 | 4,924.60 |
| Euclid | 1,269.02 | 3,763.98 |
| Eliot | 2,153.10 | 6,382.80 |
| Fort E. | 1,172.90 | 3,022.32 |
| Forest East | 1,348.30 | 3,849.95 |
| Fourth | 3,181.10 | 9,499.11 |
| Fourteenth Bridge | 245.00 | 720.00 |
| Forman | 610.51 | 1,848.56 |
| Grand River | 3,696.90 | 18,569.13 |
| Griswold | 2,500.80 | 10,937.38 |
| High East | 1,586.50 | 5,409.89 |
| High West | 1,820.90 | 5,844.61 |
| Hudson | 3,862.60 | 12,469.80 |
| Hancock West | 2,652.20 | 8,383.60 |
| John R. | 1,908.90 | 6,195.08 |
| Jay | 700.30 | 2,073.86 |
| Kercheval | 3,647.01 | 10,141.68 |
| Larned West | 120.00 | 527.07 |
| Larned East | 5,884.05 | 21,593.96 |
| La Fayette | 5,765.51 | 23,669.00 |
| Locust | 130.90 | 304.18 |
| Longfellow | 803.79 | 2,232.75 |
| Michigan | 5,156.00 | 27,924.26 |
| Maybury | 2,350.10 | 7,627.15 |
| Martin Place | 591.93 | 2,130.37 |
| McClellan | 3,008.20 | 10,869.85 |
| National | 4,145.10 | 12,602.15 |
| Orleans | 527.00 | 1,803.76 |
| Park | 3,255.80 | 11,100.00 |
| Randolph | 532.20 | 2,361.14 |
| Rowena | 1,236.30 | 3,610.07 |
| St. Antoine | 284.70 | 1,026.87 |
| St. Aubin | 3,868.00 | 12,609.29 |
| State | 85.00 | 245.23 |
| Sixth | 245.60 | 658.21 |
| Seyburn | 853.50 | 2,751.86 |
| Seminole | 823.27 | 2,383.11 |
| Third | 1,705.60 | 5,886.80 |
| Twelfth | 2,179.30 | 6,897.21 |
| Van Dyke | 2,506.60 | 8,314.69 |
| Warren West | 1,240.80 | 2,982.43 |
| Total | 102,719.86 | 350,835.71 |

The contractors for the years 1908, 1909, 1910 and 1911 required the manufacturer to leave a guarantee deposit fund equal to 5 per cent. of his contract available to the city for a period of five years, for replacements caused by defective material. This practice was discontinued this year, as it was apparent that the

streets were so satisfactory that no charge could be made against this fund.

Close inspection is made at the plant of the manufacturer by competent and reputable chemical testing companies and the lumber is also inspected before being cut into blocks. Reports on each car are filed with the city and material not in accordance with the specifications is rejected at the manufacturing plant.

The large demand for this material, during the present year, came principally from the property owners, not only in the downtown section, but also in the residential districts.

There are now, as shown, between sixty and seventy streets and every one of them is in perfect condition.

The days of high class municipal buildings and poor pavements in the same town are rapidly passing. The reason is simple. It is just as paradoxical as high class garments and inferior shoes on the same man. One of the best traveling advertisements of a city is the transient visitor and he usually takes a ride before he leaves town. The municipal buildings may be ever so ornate, but if he has to hold tight to his seat to keep from somersaulting out of his machine, his impression of that town will not be printable. And the feelings and sentiments of residents are not much different than those of the transient. The automobile is bringing with it a greater demand for smooth pavements. Municipal officials and taxpayers now realize, however, that buying paving is simply paying in advance for a certain and justly expected amount of wear-service and that some pavements really cost more than you pay for them.

While the first cost should be considered, it should be looked upon only as a part of the entire cost, as economy is purely a matter of value, not of prices.

A really good pavement for any purpose will outwear, two to one, the pavement many taxpayers often think they are "saving money on." In buying paving, it's not what you pay, but what you get for what you do pay for. For heavy traffic, creosoted wood makes a most excellent pavement and its up-keep cost is exceedingly low.

JACOB J. HAARER, Commissioner,
Dept. of Public Works, Detroit, Mich.

## Cheapening Road Construction in Michigan

The Editor of MUNICIPAL ENGINEERING:

Sir—In 1912, the Genessee County Road Commission laid twelve miles of stone road and eighteen miles of gravel road, thirty miles in all.

During 1913, we anticipate making fully ninety miles of modern roadway, mostly gravel.

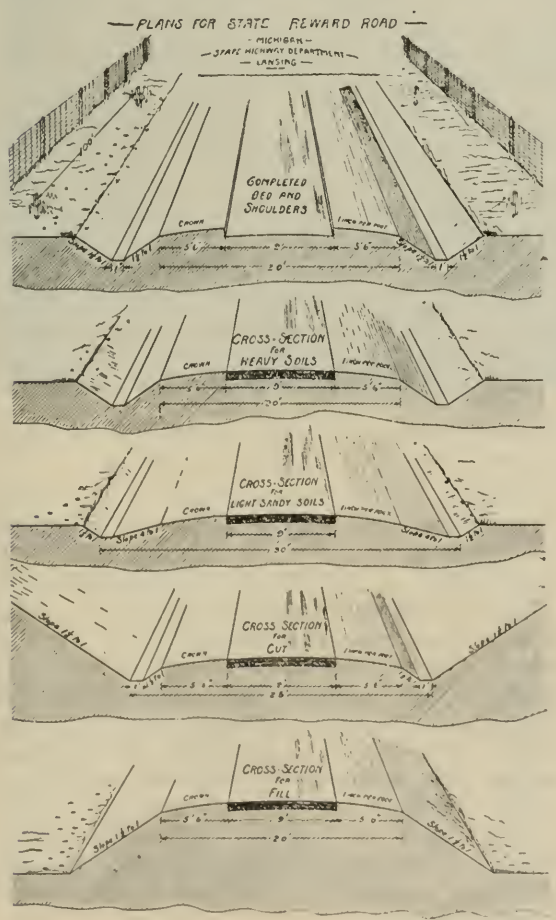
Our roads are twenty feet in width exclusive of side ditches or gutters and have a cross-section oval in form, with an average of one inch to the foot from the inner edge of ditches or gutters to the center line of the road. Twenty feet is too narrow for the roadways of heavily traveled roads, and the State Highway Department recommends that turnpikes be made from twenty-two to twenty-four feet wide where the travel is heavy. In general, earth for fills is taken from cuts. In no cases are deep, unsightly ditches cut along the roadside for the purpose of making fills.

CREOSOTED WOOD *Block Pavement. Woodward Avenue, Highland Park, Detroit, Mich..*

NICHOLS ROAD, *Montrose Township, Genesee County. Michigan.*

In clay soils, trenches are cut thru the shoulders, making outlets into the side ditches for water that may collect in the metal bed during construction and later before the surface becomes hard and waterproof. These trenches are eight inches or more in width and slightly deeper than the metal bed. They are placed at low points in the grade and not farther than 100 feet apart in retentive soils.

After the road has been graded the metal bed is formed in the central part of the road grade as follows: Shoulders of firm earth or other suitable material are placed on each side of the metal bed not less than nine feet apart or such greater distance as may be required to retain the width of metal specified. The shoulders extend to the side ditches or gutters at the same grade and curvature as required for the finished road.




PLANS *for State Reward Roads.*

After the shoulders and metal bed have been formed, the whole roadway is rolled until no more compacting is possible. The hollows developed by this rolling are filled and the roadway is again rolled and left in solid and firm condition, everywhere parallel to the finished roadway, the metal bed being seven inches below the finished grade and having the same crown. In deep, mealy sand, where rolling is impracticable when subgrade is shaped, marsh hay, rotten straw or fine brush is laid on subgrade to prevent the first course of gravel from mixing with the sand.

After the road has been graded and rolled, a layer of crushed stone or slag is spread on the prepared bed to a uniform thickness.

Improved road rollers and spreading cars have done much to modernize road building as well as to bring the cost of construction down to such a low figure as to make possible jumps from twenty miles of actual accomplishment in one year, to ninety miles the succeeding year.

Where there is enough work to keep a hauling machine busy, and suitable provision can be made for loading and unloading quickly, a hauling engine may be used to advantage, and is about 50 per cent. cheaper than horses, but in purchasing, road commissioners cannot pay too strict attention to gearing and traction wheels. There is no class of road building machinery which has been so highly developed as the steam road roller. In looking over a road roller with the view of purchasing, particular attention should be given to an investigation of the gearing and wheels. A set of rear wheels should last, under ordinary service, at least ten

years. Wheels have been in service fourteen years. The gearing on steam rollers should be of steel, cut and fitted as nicely as in any high-class automobile.

We own and operate, with great success, several road rollers, scarifiers, dump cars and water wagons, made by the Port Huron Engine and Thresher Co., Port Huron, Mich. These road rollers are durable on account of their simplicity of construction and can be entrusted to unskilled labor. These rollers are suitable for general hauling purposes because of maximum power, large boiler and engine capacities.

The ordinary traction engine is not suitable for hauling on public roads or streets, because the lugs or corrugations of the driving wheels damage good roads by cutting and loosening the surface. The corrugations or little hollows left in the road by the lugs of the regular traction driver interfere with the easy shedding of water. On the other hand, the roller improves the road, smoothens the surface for easy drainage of water and for easy traveling. Also, if the holes or low places are filled with suitable material previous to the passage of the roller and the "cars," instead of damaging the road as by the ordinary traction engine, our outfit will improve and repair the road.

The rear rolls of Port Huron general purpose rollers are beveled or pitched to provide for traveling on a good road without flattening it; or to provide for assisting in crowning while rolling. Such pitching aids in causing a suitable binding pressure on the loose material, and in giving the street or road a contour for shedding water.

The Port Huron scarifier, when used in conjunction with the steam roller, reduces picking costs to a minimum, as it will prepare for rolling from four to five thousand square yards of road surface per day. Scarifying does not affect the foundation as it loosens the surface. This method is greatly to be commended.

LYNUS WOLCOTT, Road Commissioner,
Genesee County, Mich.

## Bitulithic Pavement on Slag Foundation

The city of Birmingham, Ala., has practically mountains of slag about its iron furnaces which are being used in street construction with excellent results. The accompanying photograph shows the condition of a bitulithic street laid on a slag foundation, which was taken up to lay a street car track. Such a pavement is certainly a satisfaction both to the city owning and using it and to the company which designed the mixture and put it in place.

BITULITHIC *Pavement on Slag Foundation in Birming ham, Ala., torn up to lay street railway track. An unusually fine example of street paving.*

## Truck for Handling Water Meters

The Editor of MUNICIPAL ENGINEERING:

Sir—A 1½-ton Federal truck, as illustrated, has recently been placed in the service of the meter division of the St. Louis water department. The overhead design is of special interest, in that the quick loading and unloading of half-ton meters can be handled by the driver alone.

The weight of the chassis is 4,000 pounds and it cost $1,875. The body weighs 1,500 pounds, is 5x11 feet inside, and cost, complete with trolley and chain block, $290.

The 4-inch I-beam running the entire

length of the body and extending 30 inches over the rear, is supported by a light steel framework of 2½-inch T-bar. A half-ton trolley and chain block is mounted on this I-beam.

In replacing and installing large meters the truck backs against the curb and lifts the meter from the box in the sidewalk directly into the truck, or vice versa, by means of the trolley-chain block arrangement. Before taking out a large meter the flanged joints are loosened by

Maintenance: truck per month .....$ 85.00

Saving per month..... $180.00

The indications are that these figures will improve as the men become better accustomed to the new system and the weather becomes milder.

F. L. Bock,
Meter and Tap Division,
St. Louis Water Department.

WATER DEPARTMENT *truck for handling meters and heavy castings.*

Wages: 6 men and driver 435.00 $520.00

means of a meter puller especially designed for quick service in connection with the truck.

The truck covers a route of 15 to 30 miles a day in transferring the men from one job to another. To date the data show that a crew of 6 men divided into pairs do the work of 5 single-horse wagons with 10 men.

In figures the savings would be as follows:

Maintenance: 6 horses and wagons per month.$100.00
Wages: 10 men..... 500.00 $700.00

## Cost of Machine Concrete Mixing Compared with Hand Mixing

The Editor of Municipal Engineering:

Sir—The municipal contractor who starts in on a big job via the hand mixing method and later adopts improved machinery for mixing readily appreciates the savings effected.

We spent the summer of 1911 and 1912 on a concrete pavement job in this city, using the hand mixing method in 1911 and improved machine mixing in 1912—enabling us to make the following comparisons:

| | Hand Mixing cu. yds. | Machine Mixing cu. yds. |
|---|---|---|
| Average yardage per man on street pavement (except watchman, water and sack boys) | 2.31 | 3.83 |
| Average yardage per man on street pavement (including all engaged in the mixing operation) | 3.04 | 4.788 |
| Cost per cu. yd. of street pavement (including only wheelers, loaders, mixers and spreaders) | $0.64 | $0.508 |
| Cost per cu. yd. of street pavement (including all engaged in the mixing operation) | 1.075 | 0.74 |

The machine responsible for the above savings, and which we are now operating, is a No. 14 Kochring special paving mixer, which has an average yardage of 200 per day with the following gang:

*In Front of Machine*:

3 stone wheelers,
8 stone loaders (two loaders per barrow),
3 sand wheelers and loaders (two barrows),
1 cement wheeler (three sacks per load),
3 machine men (fireman, engineer, bucket man).

*At Rear of Machine*:

2 spreaders,
1 tamper,
1 template setter and block placer,
2 finishers.

This street paving machine renders unnecessary the barrow hauling of concrete, as it charges, mixes and deposits automatically. The bucket travels on a 25-foot boom, which swings through an angle of 170 degrees. The hinge type skip has a capacity of 14 to 17 cubic feet. feet. Our experience is that fuel burned runs from 3½ to 2 pounds of bituminous coal per square yard of pavement laid. This machine will easily ascend a 12 per cent. grade, and we run it along the work on plank sections, 8 feet in length. As a rule we place our material directly on the ground, placing the sand and granite chips on one side and the stone piles on the opposite side of the road ahead of the machine. We place the sacks of cement on top of the stone piles and the granite chips in between the road piles.

Our skip charge for the wearing surface consists of:

4 sacks cement,
3 barrows sand,
2 barrows granite chips.

The following calculations show the detailed labor costs of job A as well as summaries of the unit costs of jobs A, B, C and D, of the work above referred to:

JOB A, 3,100 Sq. Yds.

Base 5 in. 1:3:5.
Average out put equals 530 sq. yds.
Time—5.7 hrs.

| | | Total | Per sq. yd. |
|---|---|---|---|
| 9 | men on rock.....at 22½c | $11.55 | $0.0218 |
| 3 | men on sand.....at 22½c | 3.85 | 0.0073 |
| 1 | man at skip.....at 22½c | 1.28 | 0.0024 |
| 1 | man wheeling cement .....at 22½c | 1.28 | 0.0024 |
| 1 | man leveling concrete .....at 25c | 1.43 | 0.0027 |
| 1 | helper leveling concrete .....at 22½c | 1,28 | 0.0024 |
| 1 | tamper .....at 22½c | 1.28 | 0.0024 |
| 1 | engineer .. .....at 25c | 1.43 | 0.0027 |
| 1 | fireman .....at 25c | 1.43 | 0.0027 |
| 1 | bucket operator...at 15c | 0.86 | 0.0016 |
| 1 | water boy.....at 05c | .28 | 0.0005 |
| 1 | foreman .....at 45c | 2.57 | 0.0048 |
| | Total ..... | $28.80 | $0.0543 |

Wearing surface, 1½ in. 1:1:1.
Average output, 530 sq. yds.
Time, 2.8 hrs.

| | | Total | Per sq. yd. |
|---|---|---|---|
| 4 | men on granite chips .....at 22½s | $ 2.52 | $0.0048 |
| 4 | men on sand.....at 22½c | 2.52 | 0.0048 |
| 2 | men at skip.....at 22½c | 1.26 | 0.0024 |
| 2 | men wheeling cement .....at 22½c | 1.26 | 0.0024 |
| 2 | rough spreaders..at 22½c | 1.26 | 0.0024 |
| 1 | fine spreader (also tamps top) .....at 25c | 0.70 | 0.0013 |
| 1 | fireman .....at 25c | 0.70 | 0.0013 |
| 1 | engineer .....at 25c | 0.70 | 0.0013 |
| 1 | bucket operator..at 15c | 0.42 | 0.0008 |
| 1 | water boy.....at 05c | 0.14 | 0.0002 |
| 1 | sack boy.....at 05c | 0.14 | 0.0002 |
| 1 | foreman .....at 45c | 1.26 | 0.0024 |
| | Total ..... | $12.88 | $0.0245 |
| | Finishing (530 sq. yds.) | | |
| 1 | finisher 13 hrs....at 25c | $3.25 | $0.0061 |
| 1 | helper, 13 hrs.....at 22½c | 2.93 | 0.0055 |
| | Total ..... | $6.18 | $0.0116 |
| | Form Setter. | | |
| 1 | man, 10 hrs.....at 22½c | $2.25 | $0.0042 |
| | Miscellaneous. | | |
| 1 | man trimming grade, 10 hrs. | $2.25 | $0.0043 |
| 2 | men cleaning up stone, sand, etc., while top is being placed. 4.3 hrs each..... | 1.49 | 0.0036 |
| | Total ..... | $4.19 | $0.0079 |

The time required for moving the machine was 15 hours for 8 moves. The wearing surface organization is charged with moving the machine; so to arrive at cost take 1.5/2.8x$12.88, which equals $6.90.

Unit cost equals 0.013 per square yard.

SUMMARY, JOB A.

| | Per sq. yd. | Per cu. yd. |
|---|---|---|
| Development expenses | $0.0090 | $0.0500 |
| Watchman | 0.0050 | 0.0277 |
| Base | 0.0543 | 0.3008 |
| Top | 0.0245 | 0.1357 |
| Finishing | 0.0116 | 0.0643 |
| Setting Forms | 0.0042 | 0.0233 |
| Miscellaneous | 0.0079 | 0.0438 |
| Cleaning street, boulevard, etc. | 0.0055 | 0.0305 |
| Moving machine | 0.0130 | 0.0730 |
| Total | $0.1350 | $0.7481 |

The average output of 530 square yards or 95.7 cu. yds., with this organization is conservative. With no delays of any sort it could put in nine sections of 180 lin. ft. This is equivalent to 600 sq. yds. The greatest problem is to get sufficient raw material on the street. With 11 men on stone, an average of 600 sq. yds. can be placed, while a maximum of 670 sq. yds. has been attained. The cost of paving alley returns on a 30-ft. street was approximately 25 per cent. greater than the cost of paving the center of the street. This was due to the necessity of shoveling concrete for a distance of 15 feet since the boom reached only to the curb.

SUMMARY JOB B (2,300 Sq. Yds.)

| | Per sq. yd. |
|---|---|
| Development expenses | $0.0088 |
| Watchman | 0.0048 |
| Base | 0.0526 |
| Top | 0.0237 |
| Finishing | 0.0112 |
| Form setting | 0.0041 |
| Miscellaneous | 0.0071 |
| Cleaning street, boulevard, etc. | 0.0054 |
| Moving machine | 0.0125 |
| Total | $0.1302 |

Laborers' wages were 22½ cents per hour, and conditions were almost identical with those of Job A.

SUMMARY, JOB C (3,500 Sq. Yds.)

| | Per sq. yd. |
|---|---|
| Development expenses | $0.0185 |
| Watchman | 0.0060 |
| Base | 0.0595 |
| Top | 0.0268 |
| Finishing | 0.0122 |
| Form Setting | 0.0047 |
| Miscellaneous | 0.0080 |
| Cleaning street, etc. | 0.0061 |
| Moving machine | 0.0141 |
| Total | $0.1514 |

Laborers were paid 25 cents per hour on this job. Delays were frequent, due to shortage of rock, sand and men.

SUMMARY, JOB D (1,600 Sq. Yds.)

| | Per sq. yd. |
|---|---|
| Development expenses | $0.0155 |
| Watchman | 0.0060 |
| Base | 0.0584 |
| Top | 0.0260 |
| Finishing | 0.0120 |
| Form setting | 0.0042 |
| Miscellaneous | 0.0080 |
| Cleaning street | 0.0041 |
| Moving machine | 0.0130 |
| Total | $0.1472 |

C. H. Hubbell, Manager,
Hubbell Construction Co., Davenport, Ia.

## Garbage Disposal in Canton, Ohio

The Editor of Municipal Engineering:

Sir—For the past twelve years we have disposed of all garbage by means of incineration and our opinion is that this method is the most sanitary and most economical. Our destructor plant is owned by the city and was erected by The Dixon Engineering & Construction Co., of Toledo, Ohio, in 1901. The entire plant, including furnaces, building, chimney, etc., cost $20,000.00.

The building is of brick, steel and concrete construction, two stories high. The firing floor is of concrete, and the dumping, or upper floor, is made of ¼-inch steel plate. Access to the dumping floor is had by means of a timber incline approach. The driving platform on front side of building is also of timber construction.

Chimney is of common brick, 80 feet high, and lined thruout with fire brick.

The incinerator proper consists of two furnaces, built in an elongated fashion, with connecting flue in the middle. As it is arranged in two units, it is never shut down, as, if one unit is in need of repairs, these repairs can take place while the other is being operated, there being dampers to completely shut off either unit. We have found this to be a feature of economy, inasmuch as when our collections run light, we find it more economical to operate one unit at full capacity, and continuously, than two units at less than full capacity, and intermittently.

The refuse vehicles drive on to the charging and driving platform, access to which is had by means of the inclined approach described above, back up to the large doors and dump their contents into the charging holes, situated in top of furnace, and the refuse drops directly into the furnace. It is held in suspension in the middle of the furnace, resting on fire brick grates. In the front end of the furnace, at nearly a level with the garbage grates, is a grate on which fuel is used when there is not enough combustible refuse delivered at the plant to maintain the fire. The flames from this grate pass over the mass of refuse held on the fire-brick grates, and consume same from the top. Situated also in the front end of the furnace, beneath the fire-brick grates, adjacent to the other fuel grate, is another fuel grate. The flames from this grate pass under the garbage held in suspension on the fire-brick grates, eating thru the fire-brick grates, as it were, as the fire-brick grates are situated about 6 inches apart, and burn the refuse from below. The gases pass out into another chamber, termed the stench chamber. Situated in this chamber is another grate, termed the stench grate. On this grate is maintained a fire of coke. Above this gate is a checker-work of fire clay tile. The fire from the stench grate heats these tile to a very high temperature, and the gases coming from the garbage chamber must pass over the stench fire and strike

the surfaces of the heated tile, raising the temperature of the gases to a degree well above 1250 degrees Fahrenheit, completely destroying the odors.

The furnace in the main consists of a steel jacket of ¼-inch steel plate, reinforced and braced by angles and tees of structural steel. The minimum thickness of the fire-brick lining is 9 inches, and the very best grade of fire brick was used for this purpose. The repairs on the lining have been very small. However, we have given the furnaces that careful attention which is necessary on any plant of this kind.

No mechanical draft is used in this plant, but we understand that the Dixon company are building forced draft de-

cineration of the above refuse in furnaces either with a strong natural draft, or by means of a forced draft, is undoubtedly the most sanitary method known, since it completely disposes of the organic matter without repeated handling. Our system of hauling the cans to the furnace and not exposing the contents while collecting, we believe, is very effective as a means of decreasing the menace of flies, since the fly is deprived of his source of livelihood. The fly, being the carrier of germs, cannot, therefore, carry germs from the garbage to some table or to some individual.

Taken all in all, the investment made in a garbage disposal plant is a good one, when one considers what it costs a mu-

GARBAGE INCINERATION *Plant at Canton, O. Note sanitary cans unloading at left, clean cans on stand in rear of plant.*

structors at the present time. We get our draft from the high chimney, and this draft, with the use of a small amount of additional fuel, is sufficient to consume all the refuse to a fine ash, and without odor.

The garbage consists of animal and vegetable kitchen refuse. The other principal items that make up the waste of the city are ashes and rubbish, the latter consisting of paper, bottles, tin cans, etc. Our incinerator handles all of this material without regard to percentages, reducing same to an innocuous ash. The average amount of garbage per day for an ordinary household is about 2½ pounds. In-

nicipality to war with contagious disease. The original cost may seem to some cities burdensome, but when it is considered how much is saved each year in the conservation of human life, etc., the initial cost may seem trifling. Each year municipalities expend large sums of money for the protection of property by means of suitable fire-fighting apparatus, station houses, etc. Is it not as reasonable to spend something on a municipal refuse disposal plant to protect life and promote comfort as well as protect property?

PHIL H. WEBER, City Engineer.
Canton, Ohio.

## Mixing Concrete in Winter Months

The Editor of MUNICIPAL ENGINEERING:

Sir—The question of mixing concrete in winter months is of vital interest to the contractor. There are several methods used in the cold weather each with its advantages and disadvantages. The only method which should be considered is that which produces uniformly high grade concrete.

### Hand Mixing Inside of Buildings

Some contractors consider hand mixing the only method for use inside a building, but hand mixing is seldom allowed where there is an architect or inspector on the job. In the first place, the labor required to mix and handle concrete by hand is about 300 per cent. more than required by a mixer. Secondly, the concrete is not uniform and cannot be of the high quality which is required in building and reinforced concrete work. Very seldom is the concrete turned over on the boards more than about three times. Third; the freezing weather causes lumps to form in the sand and gravel which cannot be broken up by hand mixing. Fourth; concrete left standing on the boards for any length of time in freezing weather is a waste to the contractor, also poorly mixed concrete will not be accepted, which causes delay and waste to the contractor.

### Mixer Mounted on Skids Placed Inside of Building

Up to date contractors consider this the best method of mixing concrete in the winter months and secure a simple mixer mounted on skids, with a low, wide opening in the drum large enough to permit it being charged by shoveling directly into the drum, or by the use of barrows from a low platform. This type of batch mixer, which has been on the market for only a few years, can be taken thru an ordinary door and placed anywhere inside the building. This is impossible with the old, heavy, complicated, side-loading or high-charging mixers. Concrete that is mixed by guess can not be uniform, therefore the opening in the drum must be large enough to permit inspection of the entire batch while mixing. By placing the mixer within the building the concrete does not have to be rushed from the mixer to the forms, as this simple type of mixer can be placed near enough to avoid this. As the temperature of the mix in the mixer is the same as in the forms there should be no checking or cracking due to sudden changes in the temperature.

### Hot Blast Mixers

This type of mixer has an inlet thru which either steam or hot air is forced into the drum to heat the water and material. This is not only an expensive but dangerous method and has been only partially successful for a variety of reasons. The hot steam or air which is forced into the drum causes the material to expand and when the concrete is discharged the sudden change in temperature causes the material to contract. This results in checked and cracked concrete. The machine also suffers. The heated parts expand, and when the day's work is over they contract and often break the gear wheels or bands.

### Mixing with Saltpeter Preparation

This method is adopted by many contractors who have a rush job in zero weather. The saltpeter is put in water to keep the concrete from freezing and to give it ample time to set. This method is very expensive and could not be used to great advantage on big jobs. The saltpeter not only keeps the concrete from freezing but tends to make the concrete set quicker. This preparation will build up the strength and life of the concrete, providing that great care is taken to get the right proportion in every batch.

### Heating the Material

No matter what method is used for mixing, certain steps must be taken to protect or thaw the material before using. The thawing of the material can be accomplished by using sand heaters, which are ordinarily round iron pipes, about 14 inches in diameter and about ¼ inch thick. The sand or gravel is piled around and over the pipe and a fire is built in it. Another good way is to pipe live steam from either the mixer or hoisting boiler, or from a separate boiler provided for this purpose. The placing of the materials inside of buildings in bins will keep it dry and very little thawing should be necessary unless the weather is severe.

### Protecting the Concrete

There are several ways of protecting the concrete until it has had sufficient time to thoroly set. Many contractors heat their forms by forcing hot steam into the forms before pouring and then placing several layers of building paper over the exposed concrete on which is piled either straw or manure. If the weather is not too severe and the forms are built thick, this method will insure satisfactory concrete. If, however, the weather is below zero, the use of salamanders is necessary and the forms should be left on from five to seven days, according to the conditions. The contractor should consider the workmen in the winter months and if the mixer is placed inside of the building the workmen are protected from the extreme weather, the mixed concrete and material are protected from the snow and sleet, and twice the amount of high-grade concrete is turned out.

A. ———, Wis.

# ROADS AND PAVEMENTS

## Creosoted Wood Block Pavement in New York

### Borough of Richmond.

"We have 16,500 lineal feet, aggregating 50,800 square yards of cresoated wood block paving in the borough of Richmond, city of New York," states Mr. Louis L. Tribus, consulting engineer and commissioner of public works of the borough.

"The location of this paving in this borough is upon the following streets: Canal street, from Wright street to Broad street. Canal street, from City Dock to Broad street. Richmond Terrace, from Ferry street to Railroad. Richmond avenue, from Richmond Terrace to Ferry Landing. Richmond Terrace, from Lafayette avenue to Harbor road. Water street, from Bay street to Wright street. Heberton avenue, from Elizabeth street to Post avenue. Heberton avenue, from Vreeland street to North end. Barker street, from Trinity Place to Castleton avenue. Jay street, from Richmond Terrace to South street.

"The above streets carry moderately heavy traffic and are in a less worn condition than other pavements laid at the same time. Aside from its noiselessness of traffic, creosoted wood block paving is to be commended on account of its low traction resistance, long life, small cost of maintenance and cleanliness. We have few complaints on account of slipperiness and during certain seasons of the year when all pavements are more or less slippery, we simply sprinkle sand or steam ashes on our wood block and thus forestall any possible trouble.

"Our specifications differ from the other boroughs of this city in specific gravity of oil, 1.03 and 1.08; also in the quantity of naphthalene and phenol acids.

"Above mentioned pavements are very sanitary because the creosote, used in

CREOSOTED WOOD BLOCK PAVEMENT *on Clinton Avenue, from Park to Willoughby Avenue, Borough of Brooklyn, New York City.*

treating the wood, contains a large percentage of highly antiseptic ingredients, namely phenol or carbolic acid and naphthalene. These ingredients are the lighter and more volatile portions of the preservative oil and continually comes to the exposed surface of the block, the only portions which collect germs, and thus evidently keeps the street in healthful, sanitary condition. The true cost of any pavement should not be measured by the first cost alone, but also the average upkeep cost per year and the average 'annual cost' should be taken into consideration in selecting an economical pavement."

### Borough of Queens.

"Most of the creosoted wood block in Queens borough," states Mr. J. H. Weinberger, engineer in charge, "has been laid within the last eight years, altho in two instances it has been laid eleven years.

"I might add that the only cost on above streets has been such as was caused by the opening up of the pavement for house connections or other subsurface reasons and, therefore, the real maintenance cost to date has been nothing whatever.

"In the Borough of Queens, the following streets and parts of streets are paved with creosoted wood block:

| Street. | Length. | Area in Sq. Yds. |
|---|---|---|
| Academy | 930 | 3,133.58 |
| Academy | 998 | 3,485.30 |
| Broadway | 3,600 | 16,208.80 |
| Bergen | 1,440 | 5,101.39 |
| Church | 2,370 | 7,881.60 |
| Front | 370 | 1,230.18 |
| First Av. | 3,640 | 14,265.30 |
| Jamaica | 750 | 4,218.70 |
| Lefferts | 1,650 | 6,085.00 |
| Metropolitan | 4,180 | 12,165.00 |
| Park | 160 | 549.50 |
| Second Av. | 3,000 | 8,890.00 |
| Sanford | 2,840 | 13,058.40 |
| Third Av. | 3,000 | 7,782.90 |

"The above streets are in excellent condition and have been so uniformly satisfactory that in many instances property owners are petitioning for creosoted wood block for streets of both heavy and light traffic. As such improvements are paid for by assessment, the public authorities are glad to grant all such requests immediately.

"Creosoted wood block is noiseless and therefore especially desirable in both business and residential streets as well as all streets on which are located hospitals and schools. It is exceptionally easy to clean and keep in perfectly sani-

Two Creosoted Wood Block *Streets in Stapleton, Borough of Richmond, New York City.*

tary condition at a minimum expense. In my estimation, this paving is the most sanitary in Queen's borough.

"When good blocks are used and then laid with great care on a good foundation and the proper precautions taken to keep it clean, creosoted wood block pave-

CREOSOTED WOOD BLOCK PAVEMENT *on Clinton Avenue, Brooklyn Borough, New York City.*

ments are bound to give universal satisfaction.

"People appreciate the uniform smoothness of this type of pavement and we have very little complaint on account of slipperiness.

"The specifications, as used in the Queens borough, are identical with those adopted by the board of estimate and apportionment for the entire city."

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## Paving in Trenton, N. J., Under the New Commission

*By Harry F. Harris, Assistant Superintendent of Streets.*

Trenton, N. J., a city of 100,000 population, has been under commission rule for just eighteen months, but during this brief period a great number of reforms have been accomplished along all lines, which seemed an utter impossibility under the old form of government, despite the efforts of well-meaning Common Councilmen and a number of municipal officers. Chief among these reforms perhaps are the strides in the Department of Streets and Public Improvements, especially along the line of street pavements.

In the first place the city was especially fortunate in choosing a civil engineer of considerable experience as the Director of the Department of Streets and Public Improvements out of a field of some sixty candidates. One of the first things which he set about doing was to thoroly reorganize his department, and begin a study of how to improve the old chaotic conditions which had previously prevailed, due principally to lack of a definite and systematic policy in regard to improvements.

As a result of this study the following

PARKSIDE AVENUE, *Trenton, N. J., looking north from park tunnel. Single course asphalt on corrugated concrete foundation, 5 per cent grade.*

innovations or reforms have been established, among others:

Employes placed under civil service.

City chemist employed to inspect thoroly all paving materials in addition to his other duties.

Patented pavements tabooed.

Discarded municipal asphalt repair equipment put in operation again.

Open specifications adopted.

Alternate bidding on all paving work.

Bids received on entire year's work in bulk, thus enabling the city to get maximum amount of competition.

City inspectors on pavements placed on merit basis. Those most efficient getting the most work, men being employed on per diem basis. Permanent new men to be chosen by civil service examination.

Fostering of a school which meets one night each week, where employes of engineering department get together and discuss technical and practical problems concerning the work.

System for recording street maintenance costs established, whereby it is hoped that a scientific local study may ultimately be made on the life and yearly costs of the various kinds of pavements.

City assumes the right to determine the kind of material to be employed in the paving of all streets.

PARKSIDE AND WHITTIER AVENUE *intersection, Trenton, N. J. Single course asphalt on corrugated concrete base.*

City refuses to either recommend or act on petitions for water-bound macadam streets.

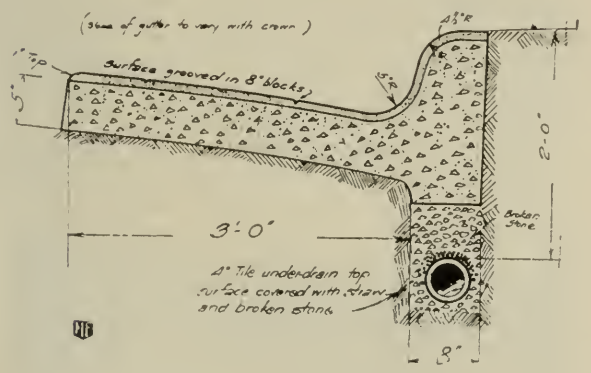
At first glance the above outline may not seem to be at all comprehensive or elaborate and it is not, except when viewed or compared with the old conditions. But it is one which must needs stand for efficiency, economy and progressiveness.

As a direct result of these policies, Trenton has obtained the cheapest and what they believe to be the best pavements ever laid in the city.

### Bituminous Concrete Pavements

Some 25,000 sq. yds. of bituminous concrete pavements have been constructed for the sum of $1.27 per sq. yd., as against the price of $1.53 for bituminous concrete and $2.48 for bitulithic, which prices prevailed the year previous. This is believed to be a record price for anywhere in the United States, so far as we have been able to determine. The price includes excavation, a portland cement concrete base, 4 inches in thickness, mixed in the proportion of 1 part cement, 3 parts sand and 6 parts washed river gravel or in several instances, crushed slag; a 2-inch wearing surface laid under the so-called Topeka specifications with the best Bermudez asphalt. Daily inspections were made at the plant, on the street and in the laboratory. This price per square yard includes the cost of setting all sewer manhole castings to grade and a 5-year guarantee.

SKETCH SHOWING TYPE OF COMBINED CONCRETE CURB AND GUTTER USED IN SUBURBAN LOCALITIES.


(Slope of gutter to vary with crown)
Surface grooved in 8" blocks
3'-0"
2'-0"
Broken Stone
4" Tile underdrain top surface covered with stone and broken stone
8"

### Sheet Asphalt Without Binder

An experiment was tried in laying two sheet asphalt pavements. The streets in question were both in residential sections and it was decided to try out the plan of laying sheet asphalt, eliminating the binder course, and substituting therefor a corrugated concrete base after a method recommended by the engineer of streets. These indentions in the concrete were made by means of a specially constructed tamper having a number of triangular shaped extensions upon its working surface, spaced about 4 inches apart, each extension being ¾ of an inch in height and about 12 inches in length. The streets upon which this form of pavement was tried each had a 5 per cent. grade, a most trying condition one must admit, for this type of construction. These two pavements were built for the average price of $1.38½ per sq. yd., which price included 5-year guarantee, excavation, a 4-inch concrete base, and a wearing surface 1½ inches in thickness of Bermudez sheet asphalt. The thickness given does not include the material driven into the ridges of the concrete by rolling.

### Concrete Pavements

Concrete pavements have been given a try-out on three alleys and a short street which gets considerable traffic. The concrete has been laid with the single and double courses. Prices, including excavation and 6 inches of concrete, have ranged from 90 cents per sq. yd. to $1.44. Wood expansion joints were used.

### Gutters on Asphalt and Bituminous Streets

In view of past experiences in getting asphalt to withstand the effects of water, concrete gutters, sometimes as wide as 3 feet, or brick gutters about 18 inches in width were used in connection with all sheet asphalt or bituminous concrete work.

### Sheet Asphalt

Only one street was constructed of sheet asphalt under the standard method and this was a street which was traversed by a double-track trolley line, making the work somewhat more difficult to handle, but this was laid for $1.61 per sq. yd., as against the price $1.98 the year previous. Prices include excavation, 4-inch concrete base (1:3:6), 1-inch binder, 2-inch wearing surface, Bermudez asphalt and 5-year guarantee.

### Brick

Vitrified block pavements laid under the Standard Specifications adopted by the American Society of Municipal Improvements, requiring a 20 per cent. abrasion test (new rattler), have brought brick pavements to between $2.23 and $2.28 per sq. yd., using Metropolitan block. Price includes excavation, 4 inches of concrete foundation (1:3:6), slag as the coarse aggregate, 1½-inch sand cushion, cement grout. The abrasion test required, while quite severe, has been adopted with the view of getting the very best block obtainable.

One has to take but a look backwards at some of the old conditions, where spirited competition was throttled; where inspectors were appointed by politicians, re-

gardless of ability or qualifications; where paving petitions were circulated in numerous instances by representatives of paving companies, ofttimes specifying particular pavements entirely unadaptable to the streets on account of traffic conditions, grades, cost, etc.; where the use of antiquated, obsolete and at times closed specifications prevailed; where the city was constantly being burdened by spurious patented pavements, some of which would not outlast the guarantee; and the utter lack of facilities at hand for rigid and thoro inspection of materials at paving plant; and still a dozen other ways by which efficient, economical and businesslike administration of public work of this nature was an impossibility, all of which, when compared with the results obtained during the first season under the new regime is something which must make the average citizen feel just a little elated or feel that some headway for the cause of good government has been made.

It has been estimated that some $15,000 has been saved, based upon the figures which obtained prior to this season, and not only was this season's work completed at considerable saving and without a decrease in quality, but it was accomplished in record time, due to the fact that the contract was let in bulk, and that a competent contractor with a good organization was able to undertake and handle the work in a systematic manner.

Such is a brief resume of what has been wrought in Trenton in a few month's time, and which may be done, in the writer's opinion, in perhaps any other municipality under similar conditions at the expenditure of a little energy and effort on the part of some public spirited citizens, looking for a just and sufficient return for their money.

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## A Sample Concrete Country Road at La Salle, Ill.

At the close of the recent Springfield Good Roads Convention, Mayor Thos. F. Doyle, of La Salle, headed a delegation from that city in conference with the Illinois state highway commissioners, on the question of building a permanent roadway from the Rock Island depot at La Salle to a point one mile south.

Plans and estimates for the work were prepared by the state highway engineer and were laid before the La Salle board of highway commissioners early in February. Meanwhile, interest in the project was aroused among the producers of roadway material in the state.

F. W. Renwick, president of the Joliet Sand and Gravel Company, Chicago, considered the enterprise a laudable one and consented to furnish free the gravel, consisting of approximately 2,800 tons, or 95 carloads. The Marquette Cement Manufacturing Company and the Chicago Portland Cement Company, Chicago, demonstrated similar interest, and will jointly furnish, without cost, the cement required, amounting to 26 carloads. The American Sand and Gravel Company, also of Chicago, stands sponsor for 54 carloads of sand, which will be shipped as required from sand pits at Buda and Lincoln.

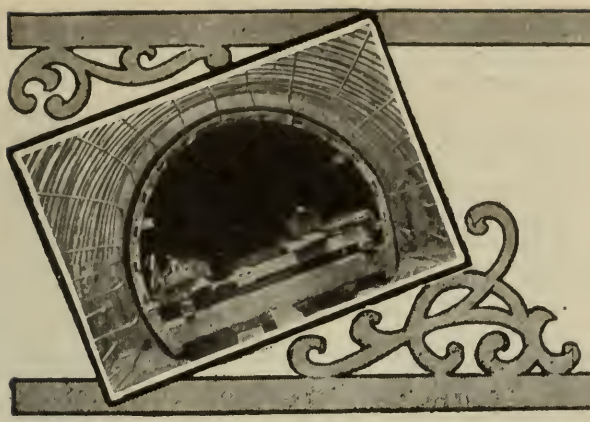
At a meeting of the La Salle board of highway commissioners, held at La Salle on Wednesday, February 5, letters were read from the donors and their respective offers were formally accepted, the board appropriating the sum of $5,000 to defray the cost of labor and fuel incidental to the work.

The Illinois highway commission at Springfield were then petitioned to supervise the building of the road, and in granting this request the state highway engineer named May 1 as the date on which the work will proceed.

The specifications of the state highway engineer call for a roadway nine-tenths of a mile long, 20 feet wide, with an average thickness of 7 inches. It will replace the old road at a point where it is subjected to heavy traffic, La Salle being the most convenient market for the prosperous farming community immediately south of the city, which must necessarily travel this highway.

The old road is in very bad condition, and has on that account been a source of complaint among farmers, hence the activity of the La Salle board of highway commissioners, who now express keen satisfaction in the rapid culmination of their plans for the replacing of it with a permanent highway of the most approved type.

The generosity of a number of Chicago business men, who, in donating the materials, have thereby contributed 60 per cent of the cost of this roadway, is also a source of gratification to the citizens of La Salle and vicinity generally.



# SANITATION

## Cleaning the Sewage Tank at Galva, Ill.

*By Lloyd Z. Jones, City Engineer, Mem. Ill. Soc. of Engineers.*

The south sewage purification plant at Galva, Ill., was built in the spring of 1910. The plant consists of a sandbox, tank 10 feet wide and 30 feet long, with sewage 7 feet deep up to outflow towards filter beds, which are about 16 feet by 34 feet each, with alley between. An 8-inch intercepter tile from the lowest manhole on the sewer system leads up to a 20-inch drainage tile, which carries sewage from the worst producing plants of the sewer district. This intercepter coming under the drain, took all the flow up to the capacity of the 8-inch tile, and only when a large amount of storm water came, did it

CLEANING *Septic Tank at Galva, Ill.*

fail to get all the flow. Consequently this purification plant got sewage and all the street-washing, and dirt, when there was a storm.

The sewer system was put in in 1911, but few connections were made that year. After hearing that plants at Wheaton and Urbana had not been working satisfactorily, I examined the tank and found a growth of sludge stiff enough to bear up a tile scoop 2½ feet above the bottom of the tank, if carefully lowered, but not dense enough to prevent the scoop being readily moved around in the sludge. This matter was at once reported to the council meeting, with the statement that it had cost Wheaton several hundred dollars to clean their septic tank. Galva is a new city, and like the man with a new watch, they forgot to wind it. By August it had become so bad that the street boss could get no discharge when he opened sludge valve. But later, when some scavengers were going to clean the tank, the valve was opened, and the tank full discharged. The sludge was 3 feet deep after much of the water had drained out of it.

The scavengers, working by contract, got down in the bottom of the tank on a large box and took out with a rope and bucket, two barrels of sludge, and then disappeared from town. The tank stood empty about a week, with the sewage running directly thru, when the sewer committee of the city council ordered the valve closed, so that the tank could fill. Later they talked with the city engineer, and got him, one Lloyd Z. Jones, to see if he could clean the tank.

In the meantime the sludge had dried and become solid enough to require considerable push on a 2 by 4-inch to make it go to the bottom. We had at our house an American Well Works centrifugal pump, 1½-inch size, and a 4 h. p. Cushman engine, with which we were accustomed to irrigate potatoes. A short piece of iron pipe was drawn down to a ¾-inch nozzle, a tee screwed on, a 16-foot length of 1-inch pipe screwed into the side connection of the tee with an elbow at the top and a 2 or 3-foot piece of plugged pipe at the top end for a handle, parallel to the nozzle, to show the direction of the jet of sewage. Short lengths of pipe increased to fit 1½-inch hose were connected by hose to the pump discharge. Several small ropes were fastened to the hose, with which to place the hose about on the bottom of the tank, and one rope on the lower end of the suction pipe. The 2-inch suction pipe with check valve was long enough to reach from the pump on the edge of the tank to the concrete at the bottom. When stirring up the solidified sludge, the suction end was drawn

up to just below the top of the sewage. Then the pump, throwing somewhere from 80 to 100 gallons per minute (force enough to throw a ¾-inch stream of water the whole length of the 30-foot tank, in air) was started, and the nozzle was pushed to the bottom of the tank, turned and moved back and forth across the tank until the whole tank was loaded with all the black roil it could carry. Then the suction was dropped to the bottom of the tank, and the discharge carried over the top to a ditch filled with brush, and covered over with dirt. At other times the sludge valve was opened a little more than the inflow of new sewage, and the jet kept running until the tank was emptied, then the work was stopped until the tank filled again.

When we started on the job, we found the alley between filter beds filled about a foot deep, with black, shiny "buggy-paint." We ran the hose and jet down into the alley, and washed it out clean. Twice afterwards we opened the sludge valve to empty the tank quickly, after we had stirred it up, and each time we got the alley filled again as at the first time. Then we thought of the only one of Josh Billings' sayings we could remember, "If a man cheat you, blame him, if he cheats you twice, blame yourself." It seems that the half mile of 10-inch discharge pipe had become nearly filled with the lighter sludge oozing out of the tank the days when the tank stood empty, when the scavengers were supposed to have been at work. So that when I would open the sludge valve the sewage could not run away fast enough but what it would back up under the filters.

We fitted some pipe so as to extend the pump discharge down into the outlet below the filters. Then we wedged the 10-inch outlet as near water-tight as we could, and with the sludge valve shut, we pumped 100 gallons per minute into the outlet tile, and it had to get somewhere. The clean sewage from the top of the tank got the sludge to moving, and scoured out the whole half mile, without any more bother.

A large piece of ¼-inch mesh wire cloth was rolled and fastened outside the check valve to keep away anything to stop the check valve inlets, and watermelon seeds were the only thing which gave any trouble.

The tank is faulty in design, as the bottom of the sludge valve is 13½ inches above the bottom of the tank, and it can not be emptied without pumping. The tank will never be able to do its best work with sewage so long as it has to "digest" that 8-inch intercepter tile full of storm water and street washings, and worse, the storm water, rushing in with a head of water above the inlet of the intercepter, has carried sludge to the farthermost distributing tiles on the filter bed, so that they were 1/3 full of dry sludge. This sludge ran clear down thru the filters, partly choking them, and made a 3 or 4-inch deposit in the conduit tiles under the filters. Some of the weeds growing in the filters were taller than I am.

We had great luck cleaning the dry sludge from under the beds. We led our pump discharge down between the filters, and inserted the nozzle into the conduit tile openings, and found we could throw a stream clear back to the end of the 15-foot passages, and could clean out one on each side of the jet with the back flow at the same time.

When we first began to work in the tank, I noticed a peculiar color in the sewage at the other end. Upon going there, and looking closely, the color was found to be caused by wiggle-tails (mosquitoes). I think that there were 100,000,000 of them. I told the council that I knew now why the people on the south side had such a scratched-up, pimply appearance, it was caused by mosquitoes raised in the south septic tank.

Soon after the tank was cleaned and filled, hundreds of black, floating rafts of mosquitoes' eggs were seen. There are from 200 to 500 eggs, standing on end in each float. No mosquitoes were seen until 5 or 6 o'clock, when they poured out of the filter beds like bees. Two quarts of kerosene the first time, and about a quart a week after that, kept the wiggle-tails out of the tank. If these, in hatching into mosquitoes, do not carefully wipe their feet and bills before leaving the surface of the sewage, it is readily seen how any disease germs, carried by the sewage, can be quickly spread over the whole town. There is more food for mosquitoes in a sewer tank than in forty acres of stagnant pools. which the health officers so diligently kerosene.

Sometime after the tank was cleaned, it was observed that the regular sewage flow had ceased. Search at the first manhole above, showed that there was no flow. Then the ground was prodded with a rod to find the intercepter in the 20-inch combined storm water and sewage drain. When found the plank roof was completely rotten, ready to take in a horse and give the city a damage suit. A good stream of sewage was going down the drain. An iron prod brought up two old shoes, and we do not know how many got away, but the sewage began to go towards the tank again.

The sanitary sewer entering the manhole with the intercepter was found to be two-thirds filled. A hose attached to a hydrant at the upper flush tank fifteen minutes scoured out the sewer, and then

we were able to see that the mischief was done by the intercepter. The intercepter discharge runs across the manhole at right angles to the sewer, and when the intercepter is running full of dirty street storm water, it deposits a sand bar in the end of the sewer outlet, and there not being enough flush tank water to remove the sand bar, there was a back-up of solid sewage. The intercepter should be enough lower than the sewer so the outfall will be kept clear.

This was practically a one-man job, the engine and pump could be loaded by one man, and the attempt of the ¾-inch jet to travel backwards was overcome by holding against the bottom, or prying against a plank, with the 16-inch pipe handle. With this outfit the tank could be cleaned by a person with his good clothes on. I had such good luck that I did not have to give my wife the money I received for the job in order to come back home. If all the sludge had to be taken out over the top of the tank, probably the quickest way would be to have two pumps, one with a double jet, and the suction of the discharge pump placed in between the two jets, so that the scourings would be sucked out as soon as made, and the tank cleaned without being emptied.

cared three whoops whether they had a $250,000 court house or transacted their legal business in a cellar. Of all the foolish ideas that ever possessed a community, it is the notion of spending loads of good money for unnecessary, ornate city buildings to "boom the town," and then neglect the condition of the streets and alleys. The average stranger who has seen fine architecture by the mile is not likely to be vastly impressed. He is impressed, and most favorably impressed, by filthy streets.

We are very jealous of our good paving in Calgary and make every effort to keep it in a cleanly condition. On our rough streets we use high pressure flushers, which carry as high as 80 pounds pressure received from the hydrants. These flushers commence their work in the center of the street and force all refuse, dirt, etc., to the gutter, thus sending the matter gathered to the catch basins, located at every street corner. We find this system most satisfactory on rough pavements, such as granitoid, and other paving having indentations on the surface. These flushers are used almost entirely during the night. During the day Kindling squeegee machines are used in the uptown district. These machines,

TANDEM *Method of Sprinkling and Washing Streets in Calgary, Alberta.*

## Street Cleaning in Calgary, Alberta, Canada

*By W. H. Cuddie, Superintendent, Street Cleaning Department.*

I have seen many towns over the country with, I will say, from 25,000 to 50,000 population, where the merry villagers have taxed themselves for fine and modern pavements and then allowed them to become buried in mud. In some of these towns not a solitary merchant in the place has energy or ambition enough to hire some cheap worker to get out with a shovel and broom and clean up the middle of the street near his store. Some of the same towns would probably spend several thousands of dollars on a fancy court house, just as if a visiting stranger

we find, do their work in an efficient manner. On street ends, during light snow or rain storms, we resort to cane and bamboo-filled horse brooms, which we refill ourselves. Of course, ordinary street sprinklers are sent ahead of these machines to flush the roadway. In our subways we use fire hose and heavy pressure water for cleaning purposes and find the system to be most satisfactory.

Our squeegee machines are giving excellent service. This machine is a combined sprinkler and cleaner as it sprinkles the pavement and cleans it at the same time.

The consumption of water is extremely small for the results attained. There is no waste, but practically every drop is caught up by the squeegee as it washes

the pavement. Tests and records of water consumption extending over long periods show consumption of slightly over one pint per square yard of pavement cleaned.

I would also like to call your attention to the fact that our street-cleaning system, as well as all departments, are municipally owned, controlled and operated. In the street-cleaning department, all the horse and other motive power required is taken care of in the large city stables.

## The Meterage System

The Editor of MUNICIPAL ENGINEERING:

Sir—Wasted water obviously serves no useful purpose, but proves a source of profit to the city when it is allowed to remain in the reservoirs until required. It also saves in operating expenses the entire sum required to pump, filter and distribute it. The cost of installing and maintaining the water meter system is less than the cost of additional pumps, filters, mains and other equipments which are not needed when the meter system is installed.

In no more forceful manner can the water meter system demonstrate its value as an economical factor of water works management, than when it shows the exact quantity of water supplied to every consumer. In this it performs the function of an individual bookkeeper where records cannot be questioned.

The general extension of the meter system in the city of Milwaukee was not introduced until 1887. At that time there were only 871 meters in service and the daily per capita was 113 gallons. With the general introduction of meters the per capita gradually became less each year until 1901, when it reached the low figure of 80 gallons. Since then the per capita has steadily increased and for the year 1912 has again reached the maximum of 113 gallons. This is of no special significance and no reflection on the meter system, as the large manufacturing industries of this city and suburbs are using more water each year without a corresponding increase in the number of consumers.

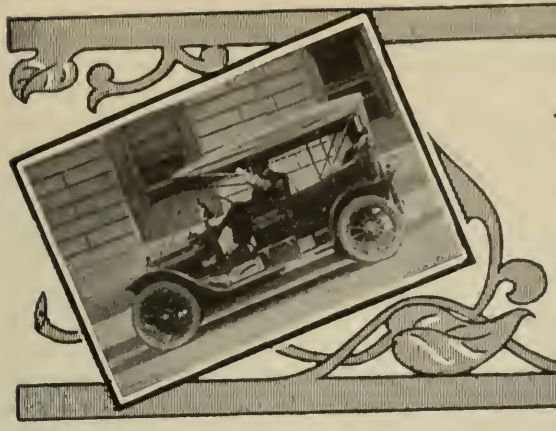
We have a number of consumers who pay all the way from $25,000 to $50,000 annually. We have a total of 58,500 consumers and out of this number less than 100 pay nearly 50 per cent. of the entire water assessment. If we eliminate the water furnished to the 100 large consumers, the daily per capita for the remaining consumers will not exceed 82 gallons. This result could not be accomplished without a general introduction of meters. Owing to the general introduction of meters, the department was able to account for all but 18 per cent. of its total pumpage for the year 1911, the metered consumption alone being over 62 per cent. of the entire pumpage. The figures for 1912 are not quite ready for publication, but undoubtedly the unmetered water will be less than in 1911. The revenue per million gallons pumped has increased 89 cents as compared with 1911. Out of the 58,500 consumers there are only 800 unmetered.

*Type of Meter Used in Milwaukee.*

A house to house inspection was made recently of the unmetered services and it was found that in many instances large quantities of water were being used in excess of the water reasonably required and in excess of the amount which consumers were entitled to under the flat rate. In many instances consumers were wasting at the rate of $200 to $500 a year on an annual payment of $8 to $10. Out of a total of 975 unmetered premises, 175 were ordered metered, where the department had positive evidence of wastage or leakage. As the department desired very much to have the remaining 800 unmetered services controlled by meters, the department made application to the Railroad Commission for the necessary authority. In a formal order the Railroad Commission authorized the department to require the installation of water meters on all premises not supplied with meters. This will go in effect May 1, 1913, and the department feels certain of a still greater reduction in the unaccounted water. This department has always taken the attitude that the method of assessing water by meter is the only fair and equitable basis, not only to the water department, but also to the consumer, and has used every effort to obtain universal meterage.

The water meter system stands today after many years' trial in all sections of the country, as an unequalled source of permanent economy in water works management. It secures the lowest operating and maintenance cost, at the same time guaranteeing the just and full returns due the city for the sale of its commodity.

HENRY P. BOHMANN, Superintendent,
Milwaukee, Wis., Water Works.



# Automobiles in Municipal Service

## Controlling Use of Department Automobiles

*By James Reed, Jr., Assistant Director of Public Works, Philadelphia, Pa.*

Six touring cars and one runabout are attached to the city hall in this department. There are five runabouts detailed to highway and street cleaning district offices. The former are operated under a pooling system. On file in this office is

Dept. of Public Works

DAILY REPORT of CAR D. 40 Cole

Date Dec 11-1912

| Time | | | Speedometer | | | Used by (Full Signature) |
|---|---|---|---|---|---|---|
| out | in | diff | out | in | diff | |
| 8 20 | 9 20 | 1 | 7387 | 7405 | 18 | Geo Ent |
| 10 30 | 11 55 | 1 25 | 7405 | 7411 | 6 | W Cullen |
| 12 | 2 50 | 2 50 | 7411 | 7423 | 12 | Geo E Datesman |
| 3 15 | 5 05 | 1 40 | 7423 | 7440 | 17 | Eug J Gubbe |
| Total Time | | 5 35 | Total dist | | 53 | |

Gasoline Gauge: Out_____ In_____ Diff_____

Gasoline Received—None—Gals. $____

Oil Received—None—Pts. _____

Miscel. Supplies_____ _____

Miscel. Repairs_____ _____

Total Expense_____

Remarks:-

Signed_____

ME W. J. Tighton Chauffeur.

*Form of Daily Report of Use of Automobiles, Philadelphia Department of Public Works.*

an approved list of those officials in the various bureaus who are authorized to request the use of a car. These requests are made in advance by telephone or in writing, to a clerk who has charge of the movements of the cars, and he details for the time specified a car of sufficient capacity to answer the requirements. The chauffeur is required to enter, in a record book carried in the car, the speedometer reading and the time on reporting and on being discharged, and the official using the car must sign opposite these entries. The chauffeur is also required to enter the amount of oil and gasoline taken during the day, any repairs, accidents, etc. These sheets are turned in daily and the various items transferred to a monthly summary sheet, which shows the cost of operation of all the cars in the department. All supplies are now purchased at wholesale prices and most of them, including tires, gasoline, etc., under annual contract.

In addition to the above, a careful tire record is kept on a tire record sheet (copy herewith), which shows the original cost of purchase, manufacturer's number, repair cost and total mileage of every shoe on every car in the department. In this way careful and accurate comparisons are available between the mileage obtained from the various makes of tires. All purchases are made on requisition order forms from this office, which must bear the signature of the assistant director, and the bills are O. K.'d by the chauffeur of the car for which the article was purchased and also by the head chauffeur as a check. They are then charged at the time of payment against the proper car, under the proper item.

You will be rather interested, I imagine, in noting the actual operating cost of the various cars for the year ending December 31st, and I am therefore attaching a summary sheet hereto which gives this information. You will note that the cost of operation and maintenance, including chauffeur's wages at one thousand dollars a year, and storage charges, averaged much lower than the

usual cost per mile to the private owner for cars of similar size and power. As of interest in this connection, I am also transmitting copies of the various orders under which the cars are operated.

The advantages of the system of control which I have described above are plainly evident, when you compare the cost of operation under this scheme with the operating cost under the previous administration. There is, of course, the additional advantage that the efficiency of the higher officials of the department is enormously increased by enabling all of them to have the use of the cars for inspection and other official duties. This applies particularly to the engineering bureaus—water, surveys, gas and lighting, and highways and street cleaning, and each car is no longer regarded as more or less the private property of some official.

In the tabular summaries of car cost above referred to one set gives the totals for each month for each car in use; another the monthly totals for all cars in use and the annual total; another the monthly and annual totals for each car separately.

The annual totals are given in the accompanying table for 1912.

Cars A and E ran for the whole year. Mileage and hours of service were not reported prior to July 1, and the mileage of these two cars prior to that date is computed on the basis of 8 miles per gallon of gasoline used.

Cars B, C and D were started July 1, and car F, September 1.

Mileage and hours are given in the table to the nearest unit to save space.

Additional equipment is not included in the cost per mile.

The detailed tables of which the table given shows only the totals, show great variations in mileage of cars per month, from zero in August for car A, followed by a repair bill of $240 in September, to 2,088 miles for the same car in May with a cost for repairs of $5. The cost for repairs is insignificant except for the two cars which ran the whole year. The average mileage per car per month is also somewhat variable, dropping down for the month that new cars were put on below that of the month before. It ranges from 994 miles in September, with six cars in operation, one for part time, to 1,706 in November, with six cars all running full time. Assuming 312 days in the year, the average mileage is 48.5 per car per day. The actual average mileage of cars in commission is probably a little larger than this, for in the computation, all cars were considered to be in commission all the time except one car out for the month of August.

TOTAL COST OF EACH CAR IN USE FOR ALL OR PART OF 1912.

| Car | Miles | Hours | Gasoline | | Car Cost in Dollars | | | | | | | | Cost per Mile, Cts. | Add. Equipment, Dollars |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gals. | Per Mile | Wages | Garage Storage | Tires, Tubes Replacements | Gasoline | Lub. Oil Grease | Repairs | Misc. | Total | | |
| A-40 Knox.. | 15487 | .... | 1722 | .11 | 916.67 | 165.00 | 679.84 | 259.45 | 11.72 | 325.42 | 19.07 | 2377.17 | 15.3 | 81.96 |
| B-30 Loco.. | 6804 | 833 | 686 | .10 | 391.06 | 105.50 | 107.94 | 105.53 | 9.77 | 2.25 | 6.00 | 728.05 | 10.7 | 167.45 |
| C-40 Cole... | 9075 | 1075 | 821 | .09 | 475.66 | 112.50 | 181.68 | 125.28 | 5.91 | ..... | 1.13 | 902.16 | 9.9 | 265.95 |
| D-40 Cole... | 7699 | 937 | 778 | .10 | 413.55 | 96.50 | 144.57 | 118.13 | 6.12 | ..... | 1.80 | 780.67 | 10.1 | 203.25 |
| E-30 Garf.. | 12591 | .... | 1459 | .12 | 1023.83 | 166.50 | 332.17 | 219.62 | 8.02 | 142.31 | 10.13 | 1902.58 | 15.1 | 51.05 |
| F-30 Loco.. | 5151 | 486 | 516 | .10 | 255.59 | 45.00 | 113.78 | 79.97 | 3.00 | 4.00 | .70 | 502.04 | 9.7 | 44.08 |
| Totals ... | 56807 | .... | 5982 | .10½ | 3476.36 | 691.00 | 1559.98 | 907.98 | 44.54 | 473.98 | 38.83 | 7192.67 | 12.7 | 813.74 |

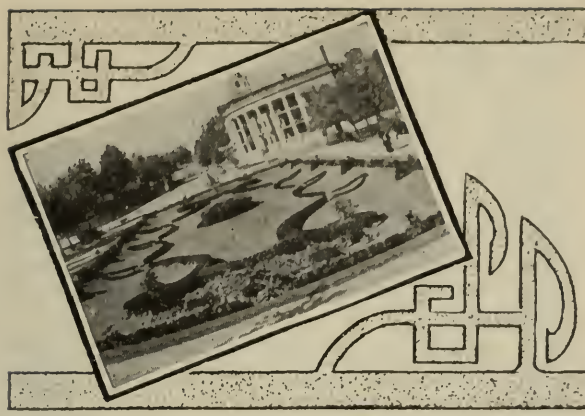
Following are from some recent letters of instruction to chauffeurs:

"Whenever it may become impossible for you, on account of sickness, or for other good reason, to report for an assignment at the hour named, you will please notify this office within time sufficient to permit of the assignment of another chauffeur in your place. And whenever you may be unable to report to the garage at the regular hour, you will also so advise this office."

"Hereafter, when any expenses are to be incurred in connection with any of the cars of this department, the chauffeur will report the fact to John Markley, chauffeur director's office, who will act as head chauffeur for the department. He will investigate the necessity for incurring the expense and will report to me whether any purchase or repairs are necessary."

"The cars of the department will not be taken out for service except on assignment from this office. When returning from an assignment you will report to Mr. Smarr, and if other instructions are not given, you will return to the garage, to await further assignment.

"Please keep correct records of all gasoline and oil used by your cars."



# CIVIC BEAUTY

## Public Sentiment Effects Civic Improvement

*By A. W. Grant, Fort Worth, Texas.*

ALL civic improvement workers are familiar with the importance and uses of public sentiment. But a serious study of this asset on the same basis as one would devote study to the treatment of a city's physical assets in preparing an improvement scheme is not so common.

Are we to leave the molding of public sentiment and using it to the best advantage to the personal tact of individual workers, or is there any way to go about determining relative values as one would prepare a formula for road material, or outline a scheme for municipal accounting?

It is the purpose of this article to raise an inquiry rather than to answer these questions dogmatically. That the inquiry is an important one has been felt, no doubt, by every civic improvement worker whom circumstances placed in a strange city and gave the task of directing that city's energies in the right direction.

It is easy for the professional city builder to say "Do thus and so" and often, from his experience, he can give valuable suggestions as to "how" the suggestions can be carried out with a minimum waste of energy. Yet we know the formula for an old and conservative New England town cannot be the same as for a bustling city of the new West; that ideas found efficient in a northern city may show a baffling failure to take root in the South.

For purposes of definition may it be said that the writer conceives civic improvement to embrace all works towards increasing efficiency in the management of municipal affairs and increasing the comfort, safety and enjoyment of a municipality's citizens.

This definition is rather large and since the different kinds of work it embraces generally fall to specialists it is apparent that the uses of public sentiment are equally varied.

For instance, in one city there may be no difficulty in obtaining the backing of public sentiment for a system of parks and boulevards, but to attach that sentiment in behalf of improved sanitation may be extremely difficult. We may find localities in which everybody seems in favor of more paved streets and better lights, but the vast majority of citizens are indifferent to a uniform and business-like system of handling municipal accounts. We find cities in which there is an overwhelming sentiment for better water facilities, but a strange neglect of fire prevention ordinances, in spite of the fact that a reduction of fire risks is one of the surest ways of increasing water supply efficiency. When a town finds itself in the conflicting currents of rival specialists each claiming his work as most deserving of public attention, then the waste of energy in the use of public sentiment becomes enormous.

For public sentiment is an asset as distinctly as a city's reputation for meeting its obligations is an asset; and it has a value as certain as the city's taxable properties.

Civic improvement work in any city generally presents three periods which, in the haste to make a showing, are sometimes overlooked. These three periods fall into the following classifications:

(1) Reform of past mistakes. (2) Work for present accomplishment. (3) Plans for systematic growth and development.

Obviously we cannot achieve success by starting with a scheme for future development and neglecting the reform of past mistakes. On the other hand, it is too frequently noted that in "reform waves," with which every city is familiar, there is a complete neglect of plans for systematic growth and development so that after the reform period, the city lapses into its old conditions.

The first step towards making public sentiment available for any work is un-

doubtedly the obtaining of confidence. The individual merchant finding himself in financial straits goes for help to the bankers in whom he has confidence. And frequently the banker is not worthy of it. That is, while he may willingly assist the straitened merchant out of his immediate difficulties, he has not performed the most valuable service, unless attached to the financial help he has given personal service in studying the causes that led up to the difficulties and outlining a course, by following which the merchant can avoid future disaster.

In this respect cities are like individuals. We go, in times of doubt, to men in whom we have confidence. Generally this confidence has little foundation except the reputation of the man consulted. We get into a municipal mess and then, when no other salvation offers, throw ourselves at the feet of one or more municipal experts and trust them to save us. And the public, mildly interested, trusts to the selection of its reform administration, or its "committee of citizens" and proceeds to go about its business, unless the experts, thus appealed to for help, have an appreciation of their responsibility to obtain public confidence to a degree much greater than that which merely lets a man alone to do his work without interference.

How often do we hear of a municipal accounting expert, called in to untangle a city's finances, going before the labor unions of the city where he is employed; to the federation of churches; to the women's clubs, and talking seriously and frankly upon the importance of business-like methods in handling a city's business? Not often.

Quite likely the expert on municipal finance is a worker and not a speaker, but that does not prevent him getting some one to create publicity, not for his personal advantage, but for the importance of his work. Public confidence is not to be obtained either by merely making a speech to the city council, or even a mass meeting of citizens. It calls for taking the work to the citizens in surroundings where they feel at home. The average citizen is not at home in a mass meeting, but find the same man in his office or in his church where he goes every Sunday or at the lodge room where he may be found every Friday night and you have him in an atmosphere where he is at ease and is prepared to listen.

Every allied interest of a municipality's citizens is worth being appealed to in order to obtain confidence. Perhaps it is drawing this proposition too far away to say that the water supply expert should spend thirty minutes valuable time discussing water supplies with the switchmen's union or at the Sons of Hermann picnic, but if an unshaken public confidence is to be obtained somebody must do just this kind of work.

And the first step is for confidence, not support, assistance or enthusiasm. Better to face a public heckling and meet all the possible opposition at the very outset, than to undertake any great work in which public sentiment is an essential to success, with a majority of the citizenship uninformed and indifferent to its importance.

In obtaining confidence an intelligent presentation of the need for the three steps already outlined will appeal to the intelligent man and serve as an excellent safety-valve for the too enthusiastic citizen. For over-enthusiasts are common and sometimes they are noisy enough and have following enough to keep opening the oven door while the cake is baking and seriously affect the results.

An effective way of dealing with the over-enthusiastic class is by providing a harmless safety valve. If a big park and boulevard scheme is under way, calling for years of work, an easy outlet is the beautification of some tract not interfering with the general scheme which may be made as elaborate as the most enthusiastic may wish. If a sanitation scheme is being worked out, the energies of the enthusiasts may be directed into a sanitation census, a listing of property owners willing to install city connections. The experience of any expert will furnish suggestions for whatever safety-valve of this kind may be needed, but provision of such outlet is not needed many times when it seems called for. A clear presentation of the importance of intelligent order in the progress of any civic improvement task should be made to the enthusiast. They are already confident and are ready to be enlisted as workers.

The molders of public sentiment are infrequently those whom the worker for civic improvement will not naturally encounter. Sometimes they are relatively obscure. The president of the women's federated clubs may not be nearly so efficient as a public sentiment molder as some member who holds no office. It should be the business of the man who expects to depend on sentiment and use it in his work to seek out the sentiment molders. Perhaps some of these are unconscious of their power. It is not always the one who can make the best public address who commands the most confidence. In a bank panic a few years ago the banks of a comparatively small city were in danger of failing together. The officials who had obtained the largest share of public attention by frequent quotation in the press and by identifying themselves with a great variety of movements were helpless to stem the tide of

public opinion to the effect that all the banks were unsafe. So in desperation they turned to one of their number who, for forty years, had, almost unconsciously, been building up a reputation for simple honesty. People who had never seen him knew his reputation for an "honest man." He was prevailed upon to make a statement for publication. It was about twenty-five words long and was to the effect that the banks of the city were sound. In a day the public sentiment shifted and the banks were saved from disastrous runs.

Frequently a few words from these quiet people have tremendous weight. The worker for civic improvement needs to study such assets and win them to his purposes.

No commentary upon public sentiment is complete without reference to the uses of the public press. The phrase "editorial support" is a vague one and frequently misused. The civic improvement worker who finds his project flattered in editorial columns but neglected by the reporters may sometimes be tempted to believe that editorial praise is more damning than helpful. The co-operation of every department of a newspaper is needed; editorial, reportorial and business office and with all three working together the press becomes a power.

The various stages of public sentiment as a tool to aid in civic improvement appeal to the imagination; as a hammer to pound its way thru opposition; as a wedge to pry into difficult obstacles; as a stimulus to energy when the way seems difficult; as a balance in which may be weighing opposing opinions when conflict between authorities seems imminent; as a forge to keep hot the purpose of the work—public sentiment may be made to serve in all of these capacities. And the civic improvement worker who aims for success does well to remember that public sentiment is a good servant, but a bad master. Does it not then, pay to study it, probe into it thoroly in every community, and make a careful survey of its possibilities at the outset of any big municipal task?

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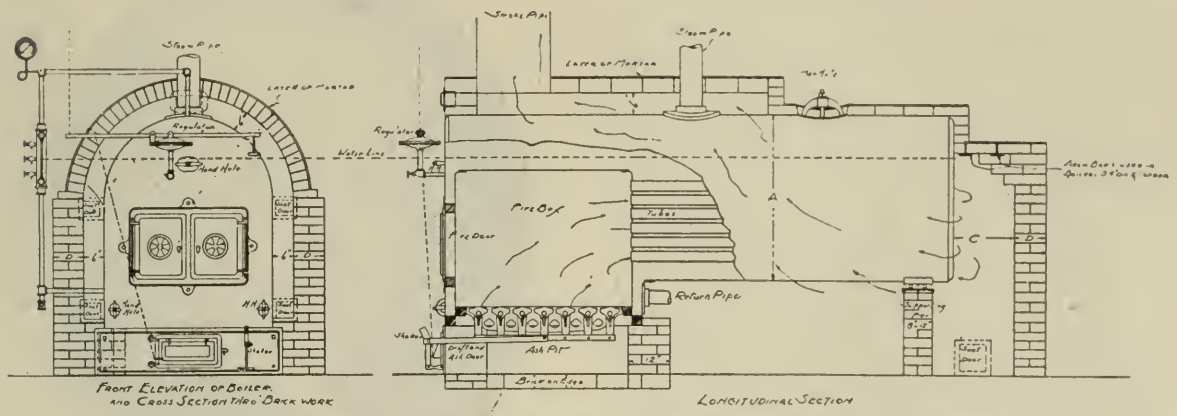
## Smoke Abatement

A bulletin issued by the Federal government has high praise for Chicago's efficient fight for the suppression of smoke. Existing conditions are contended with by the city authorities under an ordinance which has been copied by several cities. The analytical study of the great problems, conducted on a scale never before attempted in any city of the world, is in the hands of the committee organized thru co-operation of the city, the railroads and the Association of Commerce, namely, the Committee on Smoke Abatement and Electrification.

"Although there is to-day in Chicago an immense amount of coal smoke from all sorts of furnaces," the Federal bulletin says, "there is certainly no other American city that has made such marked progress toward the scientific solution of the smoke problem. Smoke abatement in Chicago, more generally than elsewhere, has been recognized and attacked as an engineering problem."




Sectional View *of Kewanee smokeless firebox boiler.*

While figures are not available for an exact comparison, the recent reports of Chicago smoke inspectors give gradually lowering averages of smoke production, but the higher figures of the special engineers employed are held to be the result of a most exhaustive investigation, substantiated by voluminous records giving one-minute interval observations for every half mile of the territory under study.

The method has been to station observers at an average distance of one-half mile apart along the line that may be under observation at a particular time. Every effort is made to keep the knowledge of the presence of the observers from

the operators on the lines, lest such knowledge would have the effect of producing improved performance. These observers make records every minute of each chimney and stack in sight.

"The gradual lessening of the smoke nuisance is due, in a large measure, to the perfecting of smokeless boilers," says a leading consulting engineer. "The municipality has found that it should practice what it preaches, and now the stacks on the majority of our public buildings are not smoking as formerly."

Lewis & Kitchen, contractors, Chicago, state: "We use the firebox boiler very extensively in our school house work, from 30 inches in diameter and 6 feet in length up to those 72 inches in diameter and 18 feet in length, for pressures running from 5 pounds to 80 pounds.

"In our two offices at Kansas City and Chicago we average the installation of heating apparatus in about 100 schools per year, and we feel that our experience is rather wide.

"We use the smokeless firebox boiler very extensively in our work. The top grates are water grates, upon which the main body of fuel is consumed; the fire on the lower grate is that which falls thru from the grates above. The draft is taken thru the door above the top body of coal, drawn down thru the burning bed of coal and passes over the hot coals on the lower grates. By this process the carbon is burned from the gases before it has a chance to be condensed into smoke.

"Many engineers do not realize that in order to secure the best results the smoke connection and chimney should have an area 15 to 25 per cent greater than the combined area of all tubes in the boiler. This is to allow for friction and expansion of the gases, which increase in volume as they are heated in the firebox. The fact of a strong draft that would draw a newspaper up the chimney is not evidence of the right kind of draft to generate steam and properly consume the coal. It requires 300 cubic feet of air for the proper combustion of one pound of ordinary coal. This air must pass thru the firebox slow enough to permit mixing with the furnace gases for proper combustion."

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## Mayor Harrison for Greater Chicago

At a recent dinner in his honor, Mayor Carter H. Harrison of Chicago, called special attention to the fact that the corporation counsel of the city has been in that office for ten years; the commissioner of public works has served in various bureaus of the public works department for many years, passing thru the offices of superintendent of streets and city controller to his present position, and the health commissioner has been drafted from the marine hospital service, where he had special training for his work.

He himself has been in the mayor's chair for ten years and has not missed a meeting of the city council.

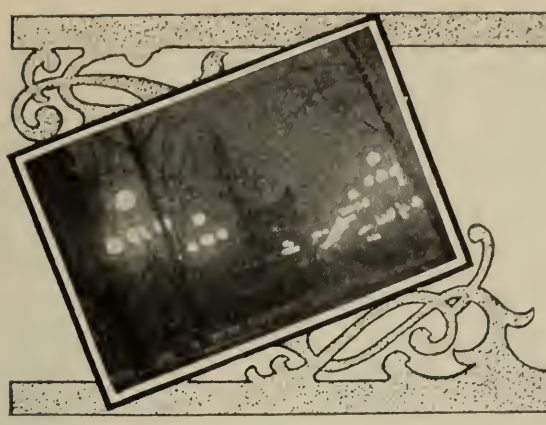
These facts show the tendency of the city administration outside the lines of the civil service toward retaining efficient men in office and promoting them without reference to partisanship.

Mayor Harrison recounted the progress made toward the great lake front project thru contract with the Illinois Central Railroad; the lack of progress on the outer harbor, because of the defective titles and insufficiency of the laws enabling the city

*Carter H. Harrison, Mayor of Chicago.*

to condemn the property; the stoppage of the Twelfth street widening by a Supreme Court decision; the general progress of the internal transportation plans, under which the city will ultimately own all the lines in the city; the general lack of money for the projects for city improvement.

He spoke enthusiastically of the beauty of the projected Greater Chicago and asked the aid of those present in securing from the legislature the right to raise more money, and from the city council the greater appropriations necessary. His energy and efficiency go far toward attaining the desired ends.



# STREET LIGHTING

## Street Lighting

*By K. G. Rennie, Consulting Illuminating Engineer of St. Joseph, Mo.*

The purpose of street lighting has remained the same, and it is now, as it was four centuries since, a measure of public safety and an adjunct to the police force. The police should be able to note the actions of suspicious characters before they stumble over them, or to detect the number of a law-breaking automobile before it has vanished into the distance. All the requirements of a complicated civilization demand lighting upon a vastly more liberal scale than sufficed for earlier days, or than is found in many localities even now. It is pertinent then to inquire into the conditions of visibility that are present with artificial light in the street, and to find their bearing upon the intensity of light required.

Except in the vision of details at comparatively short range we see things by virtue of their difference of color and luminosity. In weak light, color as such is inconspicuous, so that practical vision depends chiefly upon the power of distinguishing differences of luminosity. So far as the problems of artificial illuminations are concerned, objects do not range over a wide scale of luminosity.

Whatever may be the absolute values of light received the relative values as expressed by the coefficient of reflection range practically from about 0.1 to 0.04, or a little less. In other words, the blackest object returns about one twentieth the light returned by the brightest object. Ability to distinguish between stationary objects by their differences in luminosity depends then on the capacity of the eye as regards shade perception.

The fundamental fact underlying this is that the eye can perceive within a wide range of absolute intensity a fairly constant difference in luminosity.

As the illumination falls below about 10 lux we see less well, so that by the time the illumination is down to 1 lux our shade perception is very seriously impaired, as is also our ability to distinguish details, visual acuity, etc. It should be mentioned in this connection that the loss of shade perception at low illumination is very powerfully influenced by state of adaption of the eye with respect to light or darkness. With the eye well adapted to the dark fair shade perception can be carried into illuminations very much lower than ordinary. It is chiefly this fact which from the standpoint of street illumination, renders glaring lights so troublesome.

In twilight vision one sees things not as distinctly perceptible, but as dim forms and shades of uncertain boundaries and character. Only when the objects subtend a fairly large visual angle does one see them in the least clearly. This is the familiar vision of a bright starlight night, or a dimly illuminated street. In its beginning one cannot even distinguish large stationary obpects from their background. The first perception is that of objects in motion, which seem to catch the eye more readily than when they are at rest.

### Street Light Must Be Stronger Than Twilight

No illumination which depends chiefly on twilight vision can be seriously considered for the purposes of street lighting. It, of course, has its usual place in merely enabling one to find the way. The common citizen wants to distinguish the shadow of a post from a hole in the pavement before he is fairly upon it. The man who is driving upon the streets needs to see his way clearly, without risk of running into the gutter, and the policeman should be able to tell a belated householder from a burglar using his jimmy on a window or a front door. And finally in many places it is highly important to have enough additional light to distinguish faces clearly, to see even trivial obstacles easily and to read the numbers on houses, or if need be, to consult an address book or a time table.

I shall here classify the streets, or consider them divided for the purpose of street lighting into first, second and third class.

### Streets Requiring First-Class Light

By first class I mean the principal streets of a city from the standpoint of amount of nocturnal traffic and the requirements of the police. A chief street may be the principal business street of a city that is humming with activity after nightfall. It may be the leading street to a crowded railway station, where carriages and foot passengers are constantly circulating until late in the evening, or it may be a comparatively humble business street in a portion of the city where the police have found from experience that only constant watchfulness can keep down crime.

The streets which require first-class illumination are by no means only the streets of stately business blocks or magnificent residences. The ordinary streets of a city or town fall into another category. Traffic after nightfall is light, or only moderate.

### Streets Requiring Second-Class Light

The streets are reasonably orderly and the general conditions are such that neither from the viewpoint of the wayfarer nor from that of the policeman is brilliant illumination necessary. They are the ordinary quiet residence streets of the average city and the business streets on which there is little traffic by night. These streets would naturally figure up about three-fourths of the total mileage in the average city. These may be regarded as second-class streets from the illuminating standpoint, requiring good lighting, but not of the highest pitch of brilliancy.

### Streets Requiring Third-Class Light

Finally there are in every city a number of streets which require practically very little illumination. They are mostly in the outlying portions of the city, and sometimes they are mere roads leading away from the structural part of a city. For such it is necessary to provide only such illumination as will serve to mark the way and to render progress through them easy, considering the conditions of traffic. Occasional outlying streets, not at all important as residence streets, are still considerable traffic carriers, being thru roads from one part of the city to another, or from the city to some particular suburb or neighboring town. In these days of the very great use of motor cars almost everyone will recognize in his own town streets to which this condition applies. Such from the standpoint of the illuminating engineer are classed as second-class streets rather than third-class streets. They demand the illumination required by considerable traffic.

As to the intensity of lighting required for streets of these several classes the requirements have by popular consent been slowly and steadily rising. On the physiological basis, which enables one at least to determine what lighting is necessary for reasonably good vision for various purposes, one can form a fair approximation of conditions to be met.

### First-Class Lighting Defined

First-class streets in constant use for dense traffic of one kind or another, or so classified from the police standpoint, certainly require reading illumination, and this is the kind of illumination the first-class streets get in most European and some American cities. The intensity of the illumination required is practically that specified for public places, that is, an extreme minimum of 0.5 lux, an average of fully double that amount. Theory and practice concur in holding that a street so lighted is well lighted. In each case it should be understood that the minimum cannot be permitted to apply to any material portion of the street area. An intensity here specified mainly on theoretical grounds is substantially that deemed advisable by several foreign investigators and carried into ractice with entirely satisfactory results.

### Second-Class Lighting

As regards second-class streets the requirements are, of course, less severe. There should be, as a matter of convenience, light enough to recognize a friend without stumbling over him, to read an address, or to see the number of a house comfortably. The average illumination for this purpose may be set at not less than 0.5 lux, and the minimum should be nowhere less than about 0.25. Streets so lighted will be comfortably lighted near the lamps, and the lighting will be as good or better than moonlight, even at the darkest spot.

### Third-Class Lighting

Finally we come to the third-class streets. The degree of illumination required need not be greater than is afforded by bright moonlight, and should be as great as one finds in dim moonlight. It is illumination similar to that which is required for some of the park lighting, say from 0.3 down to 0.1 lux or thereabouts. At such low intensities it would be better to cut down the intrinsic brilliancy of the lights by screening, as in park lighting, so as not to spoil the dark adaption which is necessary for utilizing so low a degree of light. In streets so dimly lighted the silhouette effect is rather marked, and it is not desirable to forego the advantage of a tolerably light surface on the streets. The coefficient of reflection of roadways varies greatly according to their surface and the angle of incidence. (Direction of rays). At fairly large angles of incidence a dirt road, or a high dusty bit of ordinary macadam

may give coefficients as high as 0.25 to 0.35; under similar conditions a dark pavement or a bit of oiled macadam may give coefficients from half of these figures down to as low as 0.05, which low values greatly increase the difficulty of proper illumination. Considerations of economy in street lighting enforce such classification of streets as here described.

### Moonlight Schedule Insufficient

Few cities can afford even at the present scale of public expenditures to light brilliantly any large proportion of their streets. If an attempt were made to light all the streets alike there would be no first-class lighting at all. In small cities, where the traffic is never very dense, and the use of streets at night moderate, very little first-class lighting is required, and the amount necessary will diminish with the traffic. The burden of lighting perhaps falls more heavily on small cities than on large, owing to the large amount of street mileage compared with the assessable values. Hence, in such places there will be, and properly may be from the conditions, a relatively considerable amount of third-class lighting, but even so the cost of lighting is sometimes a serious matter. To keep down expense and yet to adjust the lighting conditions as well as may be, various attempts have been made to reduce the hours of lighting per year, while yet meeting fairly the practical requirements.

The earliest attempt of this kind was based on cutting out all the lights on moonlight nights. Such schedules are unsatisfactory for the weather is no respecter of moonlight, and the nights near the full moon are, in point of fact, sometimes as dark as the darkest.

The only suitable lighting for cities of any importance is the all night and every night schedule. This is commonly based on starting the lamps half an hour after sunset and extinguishing them half an hour before sunrise every day in the year. The all night and every night schedule, will be found to run between 3,900 and 4,000 hours a year. If the full schedule is to be modified it is better to modify it in the morning hours than in the hour of lighting up, by reason of the greater traffic in the evening. The so-called moonlight schedules vary according to assumptions regarding effectiveness of moonlight, but run a little over 2,000 hours per year. A modified moonlight schedule starts with lighting from dusk to midnight every night, and takes on the moonlight schedule by extinguishing approximately an hour after moonrise after midnight. Such schedules run to about 3,000 hours per year. The reduction in cost is not, of course, proportionate to the reduction in hours, so that the economy is to a certain extent rather apparent than real.

### Extinguishing Part of Lamps Better Plan

A better plan is followed in some European cities of lighting all the lights every night from dusk to midnight, or 1 o'clock, and then extinguishing part of them. This plan is coming into rapid favor in nearly all of the principal cities in America and Europe where ornamental posts are used with cluster lights, and is acknowledged to be the most economical illuminating system yet introduced. On the whole this plan is sure to give better illumination than any form of moonlight schedule which might be arranged.

The only question which is properly raised is whether it may not be feasible, say after midnight, on account of the changed conditions in the streets, and hence to reduce the illumination in them by cutting out, say every other light or cluster.

The same reasoning might apply to a few second-class streets. A consistent application of this principle might reduce the average hours of lighting per year from 4,000 of the all-night schedule to some point between 3,000 and 3,500 hours, depending on the number of lights affected. If rigorous economy in street lighting is absolutely necessary this line is the logical one to follow.

### Direction of Street Illumination

The plane of illumination, that at which the required intensity should be found, is commonly taken at 1 to 1.5 meters (3.3 to 5 feet) above the pavement, merely as a matter of convenience.

The vertical component of illumination has practically seldom to be considered in street lighting, save in its effect on nearby buildings.

A uniform spherical distribution is bad for the purpose of street lighting and the practical question regarding an illuminant for such use is how much of its effective flux of light can be conveniently turned downward upon the street. Light above the horizontal is not wasted. It does great service by illuminating buildings. A radiant for street lighting should, however, be judged substantially by the lower hemispherical intensity, taking the lamp and its reflecting system together. Reflectors of diffusing balls, or glass, are useful with all varieties of street lamps merely for the purpose of diffusing the light and to send it in useful directions.

In thickly built up important streets the enormous light flux from powerful light sources is so useful for the general purposes of illumination that it pays to employ them. Particularly this is the case since it is true both in gas and electric lighting that the very large units are of much higher efficiency than the small

ones. On the other hand, in streets requiring only moderate illumination and particularly streets hung low with shadowing trees, the small light, which for efficient use must be hung rather low, is greatly to be preferred. In streets of the third class, where every effort is being made to make little illumination go a long way in point of usefulness, and where the conditions are such that there are no lateral reflecting surfaces to be utilized, the small unit is imperative.

### Height of Street Lights

As a rule, all illuminants in American practice are mounted lower than they ought to be for efficiency, that is, lower than the point at which the form of distribution curve is utilized to the best advantage. Powerful arcs or equivalent gas lamps should be mounted at least 8 or 10 meters (26 to 33 feet) above the pavement, and with the very large units even considerably more, up to 15 or 20 meters (44 to 66 feet). Lamps of the type of the larger incandescent electric units and the corresponding gas lights need to be carried to the vicinity of 5 meters (17 feet) high (or thereabouts) for economical results, varying somewhat with the type of reflectors employed. Practically, at the present time one has to choose between radiants giving, say 50 to 200 c. p. on one hand and 500 to 2,000 on the other, only a few commercial sources running to still larger powers. In designing street illumination one virtually has to elect between using sources of the one or the other of these types.

In placing lamps, large or small, it is imperative that they should be located so that their useful light flux can be utilized. This condition is often violated by placing lamps where their light is very largely cut off by trees. By far the best method of placing street lighting poles is along the edge of the walk, close to the curb, having the units parallel up and down the section of streets to be illuminated.

### Ornamental Poles

You have often heard the following theories advanced on ornamental lighting:

First, commercial development of the city for trade follows the light.

Second, illumination value, safety and comfort for vehicles and pedestrians.

Third, civic beauty, enjoyment of the city by its citizens.

Good street lighting provides an abundance of agreeable light where it is needed, and the equipment with which it does this must add decorative effect to the appearance of a street.

It also makes money for a city, by adding to its attractiveness, increases its trade, and advertises it to the people of other places without special additional expense.

On the other hand a poor system of lighting is wasteful, as well as hideous. Nearly all of its cost is a loss. People live and do business on a street thus deprived of proper light, not of their own choice, but because they have to.

Wherever there are intensely bright light sources without having proper glass or globes, the effect in dazzling. The pupil of the eye unconsciously contracts to protect the eye against the injurious effect of this piercing light, and this makes seeing almost as difficult as does the lack of light, and much more painful. Anyone who looks at the usual form of arc light knows the momentary partial blindness and discomfort that follows.

Good illumination gives an even illumination all over the street, on footway and roadway, without any shadows. Concentrated efforts should be made to eliminate glare in one spot and darkness or shadows in another.

When first introduced the ornamental system was looked upon as an expensive luxury and would probably be used only for small installations, put in privately by individuals, or for the exterior lighting of public buildings. The use of heavy cast iron posts and expensive underground conduit construction made the system almost prohibitive. However, the introduction of standards of lighter designs and the perfection of a well-insulated lead covered steel taped cable for underground use without conduit has brought the cost of ornamental lighting within the reach of any community.

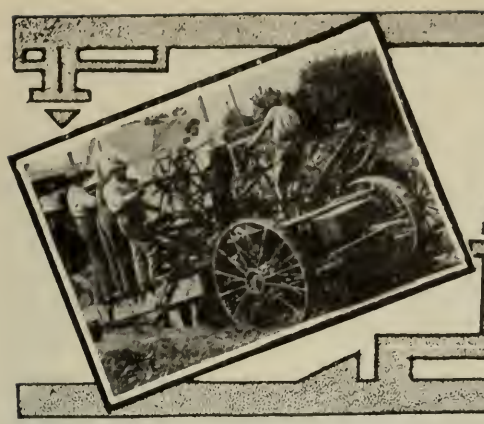
One must not overlook the fact that ornamental poles may be used in connection with gas street lighting system as well as electric. But at the present time electric lighting with ornamental poles seems to be a great deal more popular than gas. Classic ornamental street lighting poles ornament the streets in the day time as well as at night, and the general appearance of the street is very materially affected by the appearance of a handsome iron standard of classic design. These poles may be in one, two or three, four or five lights, and even more if desired, but as a rule one, three or five light standards are usually chosen.

It might be well to note that at some former time a city had installed a section of street lighting system, and at a later date would see fit to increase the illumination. This can be accomplished in three different ways:

First, to install more poles in the section desiring increased illumination.

Second, to increase the size of the iluminants.

Third, to increase the number of arms to the post, which should be so constructed as to permit of a change of this kind, without materially affecting the cost.



# PROMINENT CONTRACTORS

FILTER BED, *showing stone and riser pipes to be fitted with Taylor Nozzles.*

VIEWS *of drains and crushed stone.*

## Henry J. McNichols Company, Chicago

The Henry J. McNichols Company was founded in 1883, by Henry J. McNichols, president and treasurer; Arthur McNichols, vice president, and R. J. McNichols, secretary, with offices in the Rookery building, Chicago.

The company since its organization has made a specialty of sewer construction and has constructed many of the large sewers now in use in Chicago and surrounding country. During the year 1912 this company completed among other large contracts, 10,000 lineal feet of concrete and tile pipe sewers in Lyons, Ill., thru solid rock, at a cost of $225,000, and the outlet sewer and sewerage works for the village of LaGrange, Ill. This consisted of 170 lineal feet of tile pipe, 850 lineal feet of 8-inch tile pipe enclosed in concrete, 2,010 lineal feet of 15-inch tile pipe enclosed in concrete, 6,500 lineal feet 16-inch tile pipe, 65,000 lineal feet concrete sewer 6½ feet internal diameter, 150 lineal feet 14-inch cast iron pipe, enclosing the outfall of settling tank at side sewage pumping stations, machinery, of work, concrete manholes, catchbasins, settling tank, dosing chamber, etc.

The pumping station of the LaGrange plant is constructed of concrete and equipped with a vertical centrifugal

BUCYRUS *Steam Shovel in operation. H. J. McNichols Company, Chicago, Contractors.*

CONCRETE *and tile pipe construction through rock. H. J. McNichols Company, Chicago, Contractors.*

pump, with a submerged suction, 6 inches in diameter and cast iron casing; power furnished by a 60-cycle, 220-volt motor of 5-horse-power capacity. The dosing chamber consists of two compartments, provided with inlet valve sand siphons siphons with two filter beds made up of two concrete basins, fitted with cast iron gate main supply pipe, which connects with lateral supply lines, 5 inches in diameter, extending across the floors of filter beds, and encased in concrete. In each filter bed, 49 riser pipes, each fitted with Taylor nozzles, connect with the lateral supply pipe. Upon the floor of filter beds and around the under drains is placed a 12-inch layer of clean limestone, passing thru a 6-inch ring and retained on a 2-inch ring. Upon this is placed a layer of filter material, consisting of broken limestone, passing thru a 2-inch ring and retained on a 1¼-inch ring. The work was completed at a cost of $110,000. The plant was designed by the late W. W. Ewing, with Langdon Pearse as consulting engineer. The Central Engineering Bureau, Monadnock building, Chicago, supervised the construction. The equipment of the company consists of two Bucyrus steam shovels, one Parsons trenching machine, with Decatur backfiller attached; one back filler, equipped with a Monahan engine; three concrete mixers, one Chicago system of well points for work in wet sand and various kinds of pumps.

WASHINGTON STREET BRIDGE, *showing construction of west abutment. Fitzsimmons & Connell Dredge and Dock Co., Chicago, Contractors.*

## Fitzsimmons & Connell Dredge & Dock Co.

Fitzsimmons & Connell Dredge & Dock Co., Chicago, Ill., founded in 1870 by General Fitzsimmons and C. J. Connell; incorporated in 1878 as the Fitzsimmons & Connell Company, and in 1911 incorporated again as the Fitzsimmons & Connell Dredge & Dock Company, 1641 Otis building, with the following officers: C. J. Connell, president; H. N. Cooper, vice president and treasurer, and J. T. Lillis, secretary.

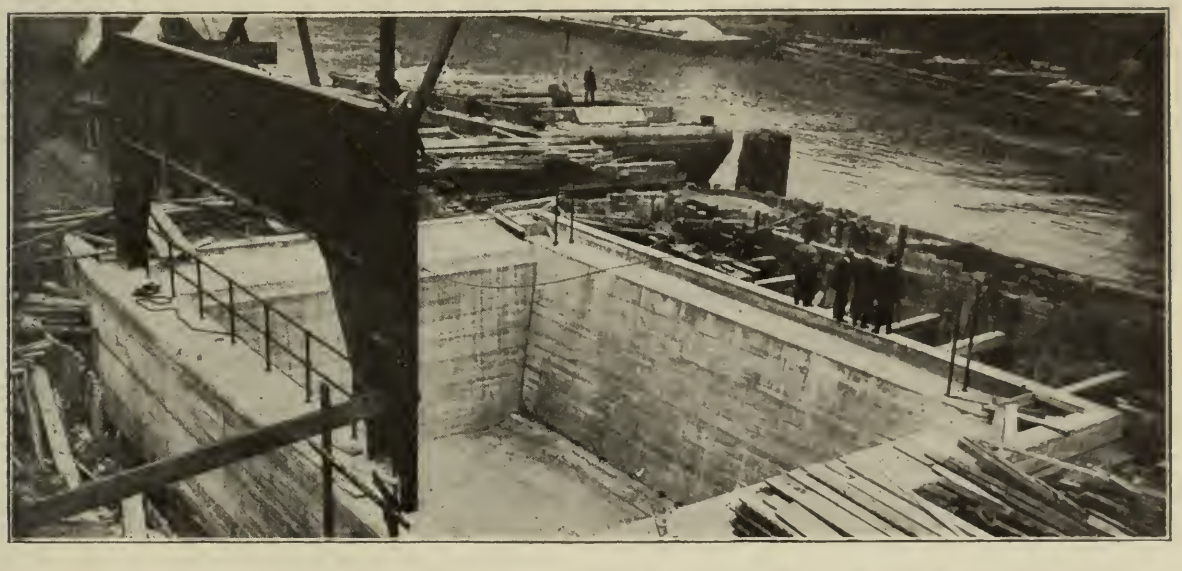
The company, since its organization, has made a specialty of river, lake and bridge substructure work and has had extensive contracts for the construction of intake cribs, water tunnels, dredging, docks, breakwaters, pile and concrete foundations, breakwater and harbor improvements. Among the larger contracts carried out by this company is the construction of the Carter Harrison crib and 10-ft. brick lined tunnel with a 13-ft. bore under Lake Michigan, connecting the crib with the land tunnel, a distance of approximately five miles, three miles of which was under the lake; the construction of a breakwater and crib protection around the Chicago avenue intake crib, and the Chicago river and the Harrison street power plant of the Commonwealth Edison Co., the construction of approximately 5,000 lineal feet of breakwater along the water front for the South Park Commissioners; the construction of the center piers of all old style swing bridges now in existence between Rush street and 12th street, over the Chicago river; the construction of the substructures of the Scherzer rolling lift bridges at Van Buren street, Taylor street and the Metropolitan elevated railway.

During the year 1912, the company was awarded the contracts for constructing and erecting a 100-ft. steel truss bridge on steel pontoons over the Chicago river at Belmont avenue, the substructure of the double leaf bascule bridge over the Chicago river at Indiana street, and the substructure of the double leaf bascule

bridge over the Chicago river at Washington street.

In the construction of the Washington street bridge, which measures 179 feet 4 inches between centers of trunnions, and lies directly above a double track street car tunnel, many complex situations arose. As this tunnel was directly beneath and parallel to the line of the bridge, it was found necessary to sink concrete cylinders on either side of the tunnel and upon this were placed concrete piers reinforced by steel trusses, the whole forming a concrete box, which straddled the tunnel without placing any load upon the roof. In the construction of the temporary cofferdams, it was found necessary to use steel sheeting of a length sufficient to withstand the pressure of the water and yet not penetrate a tunnel used by a public utility company for carrying its wires beneath the river. This required considerable back filling of clay. To support the roof of the street car tunnel, which carried this load, heavy timber bents were placed along the center line of the tunnel on jack screws and left there until cofferdam was removed. Another interesting feature of this work was the removal of the roof of the original tunnel, built in 1865, and since lowered on two different occasions.

The equipment of the company consists of two river tugs, three dipper dredges, five pile drivers, equipped with Lidgerwood and Mundy hoists and Smith, Marsh, Capron and Channon concrete mixers, and Morris centrifugal, Blake and Knowles pumps and Insley buckets.



WASHINGTON STREET BRIDGE, *showing west abutment completed.*

## Personal Notes

R. Winthrop Pratt, of Cleveland, O., has been retained to assist Charles S. Latshaw, city engineer of Fostoria, O., to prepare plans for enlarging and remodeling the purification works. He has been retained by the director of public service of Canton, O., to make a report and general plans for sewage purification plant for that city, and also to make a report upon means for protecting New Castle, Pa., from damage by floods, of which city C. H. Milholland is the city engineer.

George Y. Craig, formerly city engineer for Omaha, Neb., has been appointed city engineer of Calgary, Alta., and A. Fox. of Minneapolis, has been appointed waterworks engineer.

J. C. Travilla, street commissioner of St. Louis, Mo., has announced his intention of resigning within a short time. He will take charge of the $1,000,000 road project of Tarrant county, Texas. It is estimated that the work will require two years to complete and during that time Mr. Travilla will have headquarters in Fort Worth, but will continue to make his home in St. Louis.

J. R. Wemlinger, president, Wemlinger Steel Piling Company, has been re-elected for the second time secretary of the American Society of Engineering Contractors, with headquarters at 11 Broadway, New York, and branches in Chicago, St. Louis, Indianapolis, and Regina, Canada.

Walter H. Flood, recently in the government service, has been appointed chemical engineer in charge of the paving materials laboratory at the municipal asphalt plant, bureau of streets, Chicago, Ill.

Edward H. Kingsbury has been appointed commissioner of public works of Little Falls, N. Y.

Lewis E. Smith has been appointed city engineer of Pasadena, Cal.

# PERSONAL

## Chicago Voting Machine Contract

The Chicago Bureau of Public Efficiency recently made an investigation of what they term "the ill-advised and extravagant contract made by the Board of Election Commissioners in July, 1911, for the purchase of 1,000 voting machines, the contract price of which amounts in the aggregate to $942,500."

The first 200 machines on this order were delivered and paid for under an appropriation made in 1912. The election commissioners are asking for an appropriation to pay for 300 in 1913. This leaves 500 not yet provided for in their applications for appropriations.

The total cost of the 800 machines would be $754,000. The report of the bureau asserts that the Supreme Court of Illinois has decided that these machines do not comply with the requirements of the voting machine statute.

The Bureau of Public Efficiency made an investigation of this matter in 1911 before the contract was awarded and then recommended that not more than 100 machines be purchased until they had been thoroly tested in the primaries and election of April and November, 1912; and that the Board of Election Commissioners consult the financial authorities of the city, which must pay the bills, before taking action. To quote from the bureau's latest report: "In face of the situation above set forth, of which they were fully advised, and notwithstanding the adverse comments of the public press, the Board of Election Commissioners and the Empire Voting Machine Company disregarded every principle of business prudence and in July, 1911, entered into the contract mentioned for the purchase of 1,000 machines."

When the 1912 appropriation to pay for 200 machines was pending the bureau asked that the contract be modified to order not more than 100 machines on the first installment and make the order for the rest contingent on the success of these. But, on advice of the corporation counsel that the obligations of the Board of Election Commissioners must be paid by the council, the appropriation was made apparently without sufficient inquiry as to whether an obligation had been incurred.

The question whether the voting machines purchased by the money appropriated comply with the law was taken to the Supreme Court, which has decided that "as a matter of fact, we find that the machine does not comply with the law in enabling the voter understandingly to cast his vote in one minute."

Since the "voting machine statute is explicit on the point that no voting machine shall be purchased unless it is so constructed as to meet all the requirements specified in that act" the Chicago Bureau of Public Efficiency is of opinion that "there is no legal liability on the part of the city to pay for the voting machines in question" and that any appropriation by the council would be illegal and expose its members to severe criticism. It submits "that the claim of the Empire Voting Machine Company shall not be recognized by a contingent appropriation or in any other form" and asks that the corporation counsel be directed "to contest vigorously any suit or proceeding which may be brought to enforce payment for any of said machines."

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## St. Paul's New Civic Organ

It is a pleasure to welcome into the field of current literature created by the necessities of commercial and civic organization, a new publication, *St. Paul Ascendant*, published by the St. Paul Association of Commerce. The first issue bears a December date and it will for a time at least appear once a month. The St. Paul business world has reached that stage in organization and co-operative spirit when it requires an organ, and this one is full of promise.

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## Technical Associations

The Colorado Association of Members of the Am. Soc. C. E., listens to an illus-

trated lecture on the Reclamation Service work by Raymond F. Walter, on March 8.

More than fifty papers are on the program for the fifth annual meeting of the Illinois Water Supply Association, held at the University of Illinois, March 11 and 12.

The Minnesota Surveyors and Engineers Society held a very successful convention at St. Paul, February 11-13, with over one hundred present and a program of twenty-five papers and reports. More than two hundred attended the banquet and added impetus to the cause of good roads.

On March 12, Myron L. Fuller presents to the New England Water Works Association a paper on "Quantitative Estimation of Ground Water for Public Supplies," and the committee on water consumption and statistics relating thereto makes a report.

The Federal Aid Good Roads Convention of the American Automobile Association was held at the Hotel Raleigh, Washington, D. C., March 6 and 7.

The meeting of the National Paving Brick Manufacturers' Association at Chicago, March 3, 4 and 5, was of unusual interest. It was addressed by several men not members of the association, such as S. T. Henry, on "The Relation of the Trade Journal to Municipal Work"; H. M. Waite, chief engineer of Cincinnati, on "The Engineer's View"; E. B. Schmidt, assistant city engineer of Louisville, on "The Manufacturer, His Hindrance and His Aid," in addition to several papers by members, all tending to bring about more co-operation between engineers and brick manufacturers. The convention was held during the two weeks of the Clay Products Show, which is annually developing as an exposition of this vast field of manufacturing industry. One novelty of the show was a brick house sent by parcel post, having been built of bricks sent by makers all over the country by means of the new method of transmission.

Prof. Arthur H. Blanchard presented an illustrated paper on "The Highways of Europe" at the February 26 meeting of the Municipal Engineers of the City of New York.

The Indiana Sanitary and Water Supply Association held a successful convention in Indianapolis, February 25 and 26, with a very full program covering nearly all phases of the water supply problems.

The newly organized Chamber of Commerce of the United States of America issues a monthly publication entitled *The Nation's Business*, the latest number of which gives a report of the first annual convention of this body.

The central idea of the Panama-California International Exposition to be held in San Diego, Cal., every day of 1915, is to make the most comprehensive display ever assembled of processes, including those of manufacture. No space will be given to the display of products.

The Brooklyn Engineers' Club, 117 Remsen street, Brooklyn, N. Y., has appointed a committee of award of the Alfred T. White competition prizes for plan of reclaiming city land at Coney Island, first prize $150, second prize $50. The committee has issued specifications to be followed by the competitors, which will be sent on request, with a plat of the ground to be studied. The plans must be in the hands of the committee by May 15, 1913, and the award will be made a month later. Edward M. Bassett is the chairman of the committee of award.

## Personal Notes

G. G. Hall has been appointed city engineer of South Bend, Wash.

Stanley R. Tighe has been appointed city engineer of Cohoes, N. Y.

Will Gooden has been elected highway commissioner of Franklin, N. H.

John K. Sague has been appointed commissioner of public works and E. W. Sylvester superintendent of public works of Poughkeepsie, N. Y.

G. P. Wing has been appointed city engineer of Nashua, N. H.

J. H. Putnam has been elected city engineer of Hattiesburg, Miss.

Elmer Lenfest has been made city engineer and A. W. Campbell street commissioner and water superintendent of Snohomish, Wash.

William H. Lawton and J. K. Sullivan have been reappointed city engineer and street commissioner, respectively, of Newport, R. I.

M. L. Culley has been appointed city engineer of Jackson, Miss., and J. W. Cullen has been made street commissioner.

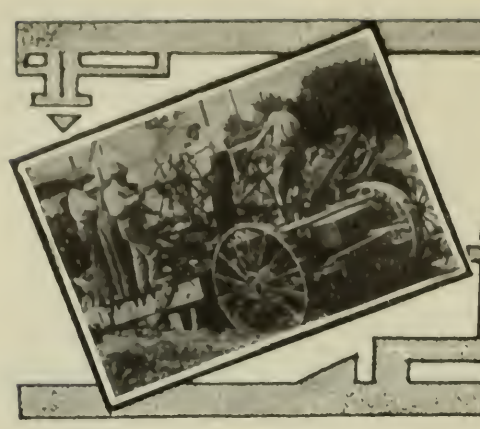
F. W. Cappelen has been appointed city engineer of Minneapolis, Minn.

Adolph Jadel has been appointed a member of the board of public works of San Francisco, Cal.

John E. Fearing has been appointed city engineer of South St. Paul Minn.

Frank W. Cherrington, formerly of Cincinnati, is now chief engineer for the Jennison-Wright Company, Toledo, O., manufacturers of creosoted ties and structural timbers.

Julian Kendrick has resigned as chief engineer of the Rudolph S. Blome Company, of Chicago, and has opened an office as consulting municipal and hydraulic engineer in the First National Bank building, Birmingham, Ala.



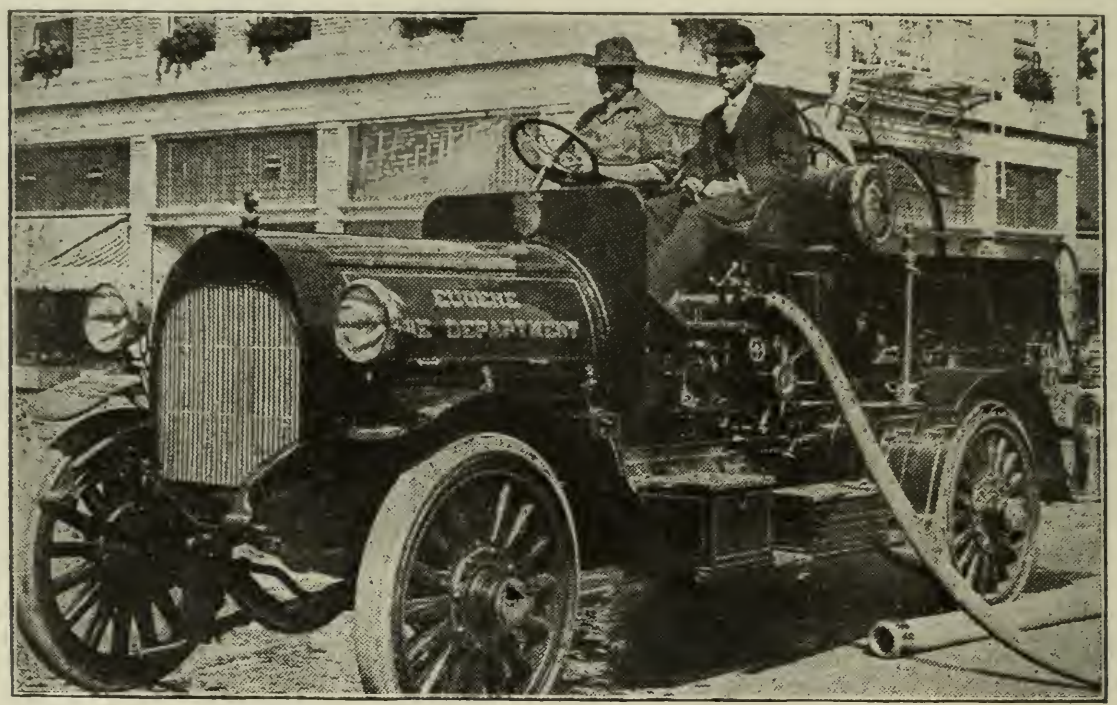
# MACHINERY AND SUPPLIES

## Oakland is Motorizing

*By N. A. Ball, Chief Engineer, Fire Department, City of Oakland, Cal.*

Altho this department has not been using motor pumping engines for any considerable length of time, our experience to date has been exceedingly gratifying, and our department will be speedily motorized throughout.

Our latest self-propelled addition is a 53-h.p. combination motor pumping engine, with chemical equipment and hose carriers. This machine has the original long stroke motor cylinders, being 5¾ by 8 inches. The intake and exhaust valves are exceptionally large, 3⅝ inches in diameter. The water space around the cylinders for cooling is more than double the space used on the average gasoline engine. The thickness of the walls, outer and inner, is more than double the thickness as commonly used in gasoline engine construction. This same comparison is noticed all thru the construction. Take, for instance, the connecting rod. It is four times the strength of that used on the ordinary gasoline engine, even of the same bore cylinders. The wristpin bearings are exceptionally heavy and large in diameter. The crankshaft, the most important part of the machine for a heavy load, is cut out of a good, solid billet of steel, not a welding, upset or squeeze in the entire operation. This is the expensive way to make a crankshaft, but it is far the best way. The crankshaft is 3 inches in diameter. The crankshaft bed is made of semi-steel, not plain cast iron. The frames are very long and heavy and are exceptionally well braced. The main frame is trussed with heavy steel rods. The transmissions are made from the very best grade of chrome-nickel steel, and every gear is cut



OAKLAND, CAL., *has added a motor fire engine like this to its department.*

from a solid block of steel. There is not a particle of forging in the entire transmission. The teeth are very heavy and wide across the face.

The same double construction also applies to the axles. The front axle is 2¾ inches at the collar, while the rear axles are 3⅛ inches at the collar, and it is very unlikely that they will ever sag or spring, tho subjected to the hardest kind of usage. I understand that these axles, and they particularly appeal to a fire engineer, were designed by the designing engineer of the Nott Fire Engine Co., and made by the Sheldon Axle Co., Wilkes-Barre, Pa.

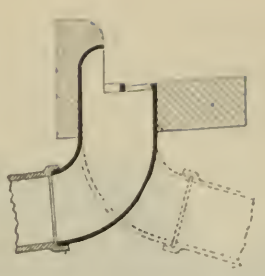
This engine has a rated capacity of 500 gallons, and easily delivers 542 gallons thru two lines of 2¾-inch hose and two 2⅛-inch nozzles, at 113 pounds net pressure on the pump, with a lift of 12 feet and 4 inches.

Seven men are required, in a residence district, to operate this engine, after same is set and working at a fire. One man can operate the pump itself. The salaries are as follows: Captain, $135; driver, $102; five hosemen, $102 per month each. This is for first year of service. Add $10 each with the exception of captain for second year and $5 each for third year and succeeding years. Duties of captain are those of regular captain of company. The driver is the only man required for operation of motor. Other men have been trained to operate machine in absence of the regular driver.

The Oakland fire department is growing rapidly. The department, at present, consists of sixteen engine companies, including engines and wagons, high-pressure pumping station, five truck companies, one chemical and three combination hose and chemical companies. The department numbers 262 officers and men. Three new fire houses are now being completed, which will give twenty-two houses in all. We already maintain seven pieces of motor-driven apparatus and seventy-six horses. The companies carry 38,700 feet of hose. There are 228 fire boxes in the police, fire and telegraph system. The cost of maintenance of the department for the year 1911-1912 was $364,708.19.

## The Municipal Gutter Inlet

The Municipal inlet was designed to meet the conditions where the existing catchbasins are in a position other than on the line of the curb of a proposed street improvement. The catchbasins are located and built at fixed distances from the center lines of the streets where the sewer system is installed, and consequently will be in the line of the curb for one width of the roadway only. This means that it will be found generally necessary to convey the street drainage from the gutter to the existing catchbasins by means of an inlet and sewer pipe connection. The old method of providing for an opening through the curb and connecting to the catchbasin brought the pipe connection within a few inches of the surface of the parkway, which will readily be noted as poor construction.

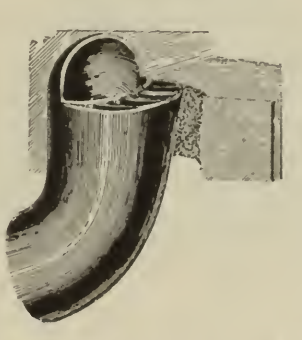


Cross Section *showing connection to catchbasin in parkway, dotted lines showing connection to catchbasin if in roadway.*

The Municipal inlet is a one-piece iron casting, set in the curb and gutter, and because of its goose-neck design, makes its junction with the sewer pipe connection to the catchbasin well below the parkway.

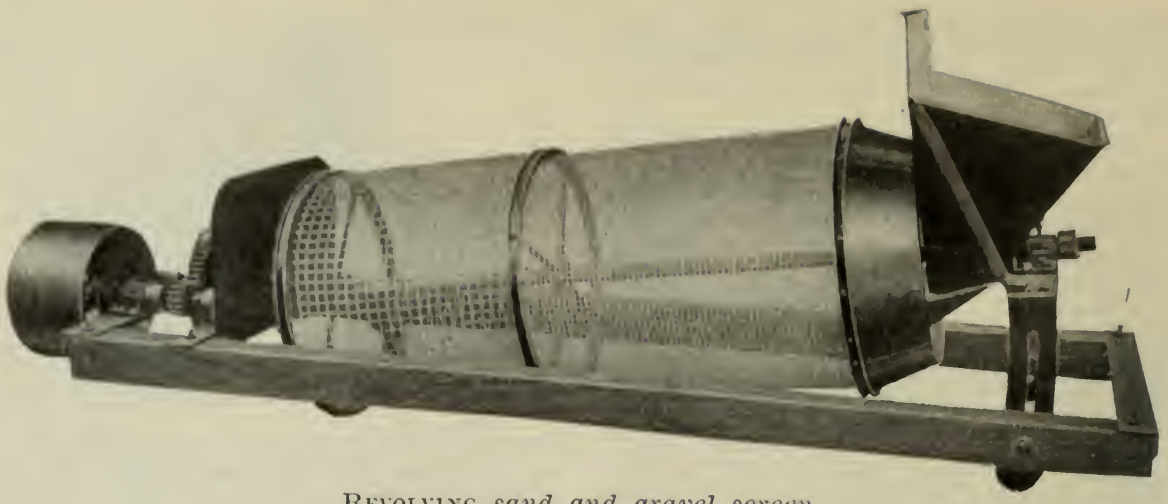
This inlet is made of one solid casting and has no grates to become loose and carried away. Because of the "hooded" height above the surface of the gutter, it is almost impossible for the inlet to become clogged, and it is easily rodded and flushed.

When the street improvement provides for curb and gutter, the inlet is set in accurate position and the concrete is merely tamped around it, allowing of the uninterrupted construction of the curb and gutter. This feature will appeal to both engineer and contractor. The appearance of the street being important, it will be noted that this inlet when in place presents a pleasing and inconspicuous effect.



*Sectional view showing a No. 3 Municipal inlet in position.*

These inlets can be made in different sizes to meet requirements, and are made by the Municipal Inlet Company, of Chicago, who will be pleased to furnish any further details.



REVOLVING *sand and gravel screen.*

## Revolving Sand Screen

The sand and gravel screen, shown on this page and manufactured by the Cement Tiling Machinery Co., Waterloo, Ia., is exceedingly simple in construction. It is being extensively used in the municipal contracting field as it obviates the necessity of divers cumbersome and expensive machinery, thus placing the screening and grading of sand and gravel among the more simple problems which the contractor must contend with.

The machine illustrated has a capacity of 500 cubic yards per day and has an 8-foot bed, 4-foot 6-inch by 2-foot drum, covered with galvanized wire cloth mesh to suit requirements.

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## Economical Squeegee Cleaning

*By Wm. A. Larkins, Commissioner of Street Cleaning, Baltimore, Md.*

The abnormal growth of Baltimore has placed her in the front rank of the country's principal cities, and in her methods of street cleaning and economies she is keeping pace with her sister municipalities. Therefore the blocking system among the hand-broom sweepers in lieu of gang or section service has been introduced upon our improved streets and in the commercial part of the city. By the traffic block system, where the hand carts have been used with most satisfactory results, we are encouraging the extension of the blocking method to all of Baltimore's improved streets, as soon as the same are completed by the paving commission. This system with the washing machines as an adjunct places our city in the front ranks of the cleanest cities.

There is no doubt but the public health is seriously affected by dust rising from streets. It has been proven by Metchnikoff, of Paris, that much of the infant mortality in summer in the cities is due to microbes found in the manure of horses. In dry weather these microbes are spread by the winds, entering houses and proving fatal to young children.

For above reasons we avoid all possible raising of street dust and in attainment of above aim make a very extensive use of squeegee machines. We have regular routes mapped out for the machines on regular days, and we find that they easily clean 45,000 to 50,000 square yards of pavements in a day of eight hours. We send the squeegees over bitulithic, sheet asphalt, asphalt block and vitrified brick pavement with equally good success.

This machine, which is a German invention and is manufactured by the Kindling Machinery Co., Milwaukee, Wis., sprinkles the water in the street like an ordinary cart and immediately scrubs the pavement with a large rubber squeegee. It is extremely economical in operation and in fact it does the work of sprinkling wagon, street sweeper and hand scraper.

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## Ornamental Drinking Fountains

*By W. T. Marlatt, Kenosha, Wis.*

One of the fundamental difficulties encountered in providing the public with drinking places rests in the securing of a fountain that is as ornamental as it is sanitary and as sanitary as it is ornamental.

Kenosha has now proven to her satisfaction that such a combination is possible as the fountains now in use not only provide a separate drinking place for dogs but they are so constructed that these animals cannot gain access to the bubblers.

On January 22, 1911, on the most prominent corner in the city was placed a Lansing sanitary fountain, an exact duplicate of the fountain erected in LaFayette Square, Washington.

This fountain faces the main square

and during the warm summer months quenches the thirst of from five to ten thousand people daily. It has been put to a severe test, from the standpoint of wear and tear from almost constant usage. In spite of this fact, the city has not expended a cent for maintenance or up-keep. Altho it is connected with artesian water mains, carrying water highly charged with both iron and sulphur, both tubes and bubblers are apparently in as good condition as when first purchased. On account of these facts the council committee on public grounds is planning to install similar fountains in other portions of the city to take the place of the old-style cumbersome iron fountains, which have become burdensome on account of their cost of up-keep. The fountain is made entirely of bronze and it is more than 12 feet in height. It has four sanitary cups for the use of persons and in addition has a drinking fountain for dogs at the base. For years Kenosha has been without a place for dogs to drink and the new fountain soon found many friends among canines. The whole is perfectly proportioned and at the top is an electric light. The fountain is decidedly ornamental.

The sanitary features of the fountain have been highly praised by the medical experts of the city. This fountain permits every one to drink with equal ease. The bubbler is raised to the height of the lips, while with all other fountains the lips must be brought to the position of the bubbler.

Briefly described, the principal feature of the fountain is in the hose and cup arrangement, which consists of a double tube, the inner tube being the feed pipe for the bubbler, the outer tube acting as a waste pipe for carrying away the surplus water while the person is drinking.

The bowls, pedestal, upper standards and brackets are made of handsomely enameled cast iron. This material avoids any chipping or breaking. This fountain will last as long as marble. The cups are made of aluminum highly polished.

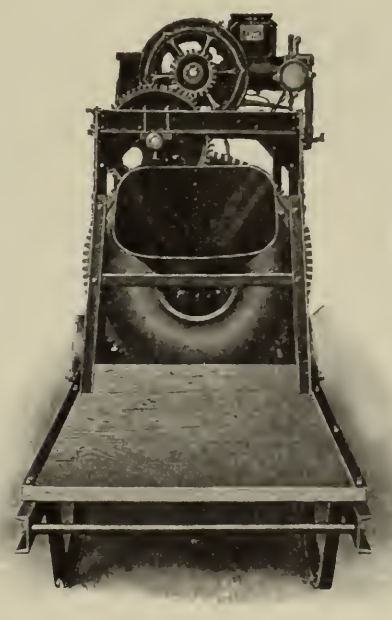
The tubes are made of best quality of pure rubber. The water keeping the rubber cool at all times, prevents their decaying. These tubes that have been in constant use for over a year are apparently as solid as when new, and it is safe to say that they will last from three to four years. They are easily replaced at any time.

This fountain, which is made by the Gier & Dail Mfg. Co., Lansing, Mich., was dedicated October 23, 1911. More than a thousand people attended the ceremonies, at which William Jennings Bryan was the principal speaker.

## A Mixer With Overhead Drive

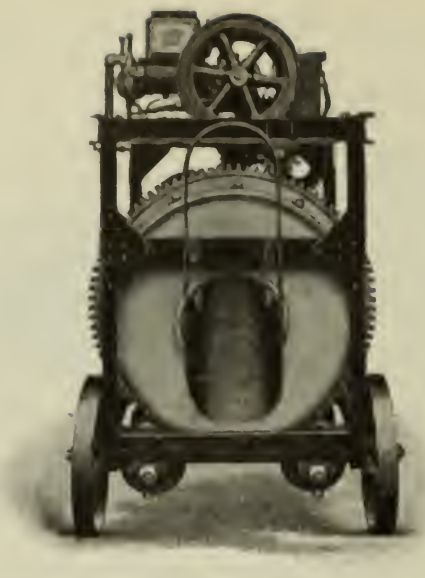
Concrete delivered directly from the mixer to the work is what may be done with the Badger concrete mixer, made by the Badger Concrete Mixer and Machinery Company, Watkins building, Milwaukee, Wis. The Badger is a typical end-discharge machine of the batch, revolving drum type, so arranged as to spout concrete delivery into the forms. The drum has a rated capacity of 6 cubic feet of mixed material per batch, or 9 cubic feet of loose, unmixed material. Its total average, estimated in cubic yards, with a factor of safety for loss of time, moving and ordinary delays, figured at 15 per cent of the efficiency, is 75 cubic yards per day, or 450 surface yards of 6-inch concrete per 10-hour run.

A record run of the Badger mixer was made on a street paving job near Birmingham, Ala., in the town of Bessemer, by the Southern Asphalt and Construction Company, of Birmingham, by the operation of two of these machines working abreast on a 30-foot street. Statistics



BADGER *Concrete Mixer, charging end.*

show that the output of these two machines, with seventeen men and a water boy, in operation, was 180 cubic yards, or 1,080 surface yards of 6-inch concrete on the one day's run. The materials were only wheeled to the 15-inch platform of the mixer and dumped directly into the batch hopper bin; at the same time a batch was being mixed in the drum proper. On account of the extreme lightness and easy portability of the machine, two men, by means of the handlebar arrangement at the rear of the loading platform, were able to constantly pull back the ma-



BADGER *Concrete Mixer, delivering end.*

chine as the work progressed. On this run horse carts and such equipment were entirely eliminated.

Two of the unique features of this mixer are its overhead drive and modern transmission. The power is transmitted to the roller shaft from the main drive shaft by means of bevel gearings held in place by extra heavy bearings which are securely fastened to the main frame and reamed in place to a perfect alignment. At the top of the main driving shaft is a small set of beveled gears to which power is transmitted from the 4-h.p. variable speed engine, by means of silent chain drive, with standard cut steel automobile sprockets. There is a double clutch feature in connection with the power plant above the machine, and the engine can run independent of the mixer, operating trench pumps, conveyors or hoists, and for lighter loads by throwing the clutch on the beveled gears.

The accompanying illustrations show the 1912 model, but in the 1913 type there is a very noticeable change in the application of power. There are absolutely no gearings, sprockets or chains surrounding drum. The drum is driven entirely by friction by means of V-shaped machined tracks surrounding the drum, bearing directly upon the involute V-shaped rollers. There are seven bearings in the 1913 type, and all these are fitted with something practically new to the mixer world for the elimination of friction. The manufacturers of this machine feel that their expenditure for highest roller bearings will doubly reward them in the elimination of breakdowns occasioned by overheating, etc., at the same time reducing the pull on the engine. The length of the Badger is 9 feet 6 inches, its width over the wheels 3 feet 10 inches, and its extreme height from the ground level to the top of the engine is 7 feet. Its weight complete, ready for shipment, is 2,000 pounds.

Full particulars may be had by addressing Mr. G. L. Sexton, of the Badger Concrete Mixer and Machinery Company, Watkins building, Milwaukee, Wis.

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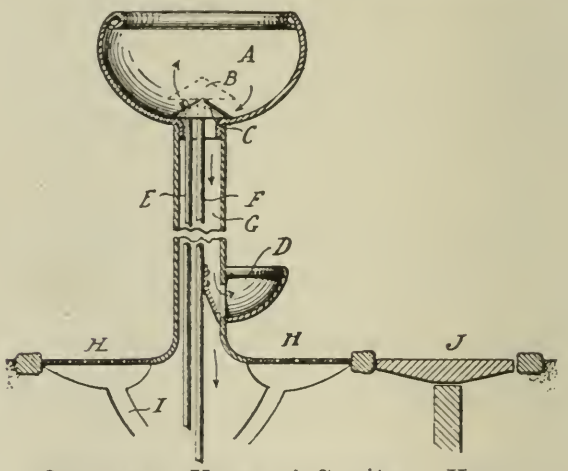
## New Sanitary Horse Trough

Following is a brief description of the main features of a new sanitary fountain for horses:

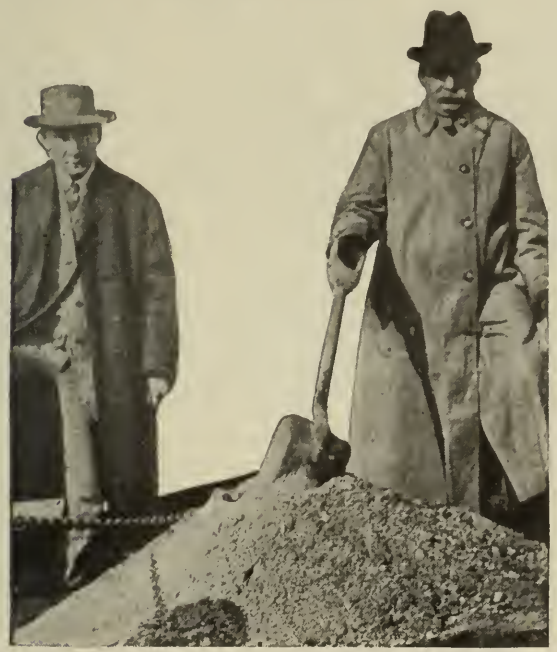
A is a drinking fount of sufficient size to hold a normal drink for a horse, and set high or low, as deemed best for checked or unchecked horses. It is set upon a standard, G, that serves as a waste pipe. Inside of this is the supply pipe E and a stopped rod, F. H H are perforated drains around a fountain to carry off the water that is slopped over, and D is a little dog fount that simply catches the waste from the overflow above. At some point near the fountain, where a horse has to place his feet in order to drink from the fountain, would be a platform device, J, not unlike a scale platform. Normally the stopper C is in position D and the fount is dry. By a simple system of levers, etc., when a horse approaches to drink he is bound to get his front feet on J, which yields sufficiently to operate the mechanism, but not enough to bother a horse. This closes down stopper C and opens the valve in E, and as long as he stands there that valve is open




SECTIONAL VIEW *of Sanitary Horse Trough.*

and the water is running. When he leaves that position the water is closed off, the stopper rises, and the fount is empty of any residue water. Each horse gets a drink of fresh, clean water, and the tank is flushed after every drink. The saving of water over the continuously running tank is also an item in its favor. Plus which, it is an anti-freezing

fountain. The water valve can be, as in most hydrants, well below freezing, and a self-drainer, and there being no water left in the tank, it is a fount that can be kept in operation all winter. It would be a matter simple enough to protect J so that that mechanism would not necessarily fill with water and freeze.



PILE OF GRAVEL *carried thru a twelve-inch pipe by turbine sewer cleaning machine, Nov. 22-23, 1912, under forty pounds water pressure, in Milwaukee, Wis.*

## Modern Sewer Cleaning in Milwaukee, Wis.

*By Henry J. Kruse, Supt. of Sewers, Milwaukee, Wis.*

As sewers are built at the present time you have to use pipe that is made in 2½-ft. lengths and consequently you have a joint every 2½ feet as the depth of the socket is greater than the thickness of the shell of the pipe. Very often, and in fact nearly all the time, you will find an offset made by reason of the cement joint being pushed up into the pipe and leaving the pipe just laid about ½ inch lower than the preceding pipe. The two conditions cause unclean and decomposed putrid matter to lodge along the bottom of the pipe sewers.

Many experiments have been made by noted sanitary engineers of England, France and America. Levy & Miquel, of Paris, Petri, of Berlin, Laws and Andrews, of London, have issued very complete reports on the subject. Mayor Horrocks, of England, made tests which show that there might be considerable danger of infection by sewer air-borne bacteria. The results of these tests were clearly set forth by F. H. Coults, M. D., B. S., D. H. P., F. C. S., before a sessional meeting of the Royal Sanitary Institute at Blackpool, England. Petri plates suspended in a ventilating shaft, such as a manhole, 9 inches above the surface of soapy water containing B. prodigiosus, were infected readily, thus showing that currents of air passing up the vertical shaft would carry the bacteria out into the open air.

Before the validity of the germ theory had impressed itself upon medical men, many diseases were attributed to sewer-gas. Later, when it was understood that typhoid, for instance, was caused only by swallowing the typhoid germ, and it had been found that the foul air of sewers and drains carried many kinds of bacteria, it began to be thought that sewer-gas, after all, might be very disagreeable and injurious.

The foregoing are statements proving conclusively that it pays to keep the sewers of a city in a cleanly condition and emphasizing the needs of machinery which will accomplish this desired result at a minimum cost.

At one of our tests of sewer cleaning machinery, we cleaned 319 feet of badly clogged 12-inch sewer in sixteen hours with four men at a cost of $15, or 5 cents per lineal foot. In case we had not used this machine it would have been necessary to dig up the sewer. With 6 feet of frost in the ground, it would have cost the city from $3.00 to $4.00 per foot for digging up and relaying.

On November 22-23, 1912, the city of Milwaukee used the Turbine machine in cleaning 270 feet of 12-inch pipe with 6 inches of gravel at one end and 9 inches of gravel at the starting point, or an average of 7½ inches of gravel thruout, at the following cost:

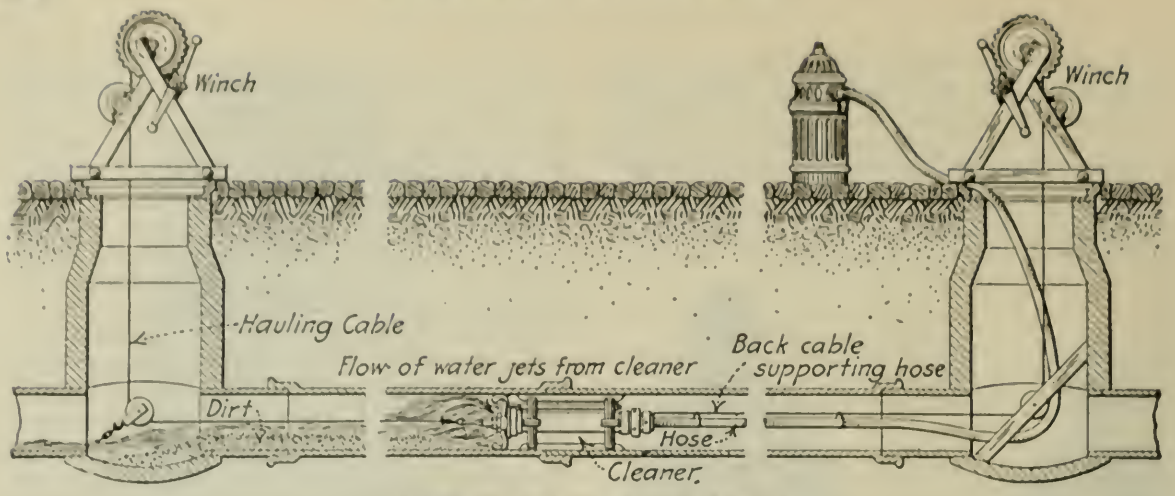
| | |
|---|---|
| Nov. 22—One team hauling machine, 4½ hours, at 50c | $2.25 |
| Nov. 22—Four laborers, six hours each, 24 hours, at 25c | 6.00 |
| Nov. 22—33,920 gallons water, meter per M, at 6c | 2.04 |
| Nov. 23—One team hauling machine, 2½ hours, at 50c | 1.25 |
| Nov. 23—Four laborers, eight hours each, 32 hours, at 25c | 8.00 |
| Nov. 23—38,160 gallons water, meter per M, at 6c | 2.29 |
| Tot. cost cleaning 270 ft. 12-in. pipe. | $21.83 |

Cost per foot—$0.0804.

By way of comparison, will state that old methods of sewer cleaning would have required three men and team fully three days to have cleaned the same amount of sewer under the same conditions as mentioned above. In other words, costs would have been:

| | |
|---|---|
| One team, 3 days, at $4 per day | $12.00 |
| Three laborers, 3 days, at $2 per day. | 18.00 |
| 457,920 gallons water, at 6c per M.. | 27.47 |
| Total cost by old methods | $57.47 |

Cost per foot—$0.21404.

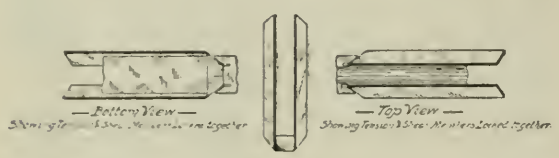



TURBINE *Sewer Cleaning Machine.*

## Concrete Bridge Re-Inforcing

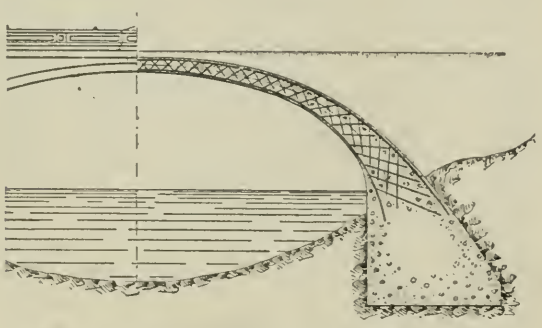
In the furtherance of safe, durable and well-balanced concrete bridge construction the Thomas Steel Reinforcing Company, Detroit, Mich., are featuring the "Thomas System," which may be briefly described as follows:

This system provides both theoretically and practically for all stresses, it being claimed that all tension stresses are taken accurately by the steel and compression stresses by the concrete. Shear members may be had in any length or




any section within practical limits and spaced rationally. Shear members or stirrups are kept in stock in standard lengths from 6 inches to 36 inches, crated, tagged and ready to be shipped to the works, where they are fastened to the tension bars by a small apparatus that squeezes the wings made by the punching of the flanges of the bars, or, if it is desired, the reinforcing bars may be sent from the shop with shear members attached, ready to be placed in the forms. Any length of shear members can be used on the same bar, and they may be hooked at the ends very easily and spaced according to mathematical calculation.

The bars may be used with the shear members placed around the flange or the stem of the bar, as shown in accompanying drawings. This double operation may be used in beams of top and bottom reinforcements and negative moments, over columns in continuous beams. The manner of attaching the shear members produces desirable corrugation on the under side of the bar.



SHOWING *lattice effect of shear members.*

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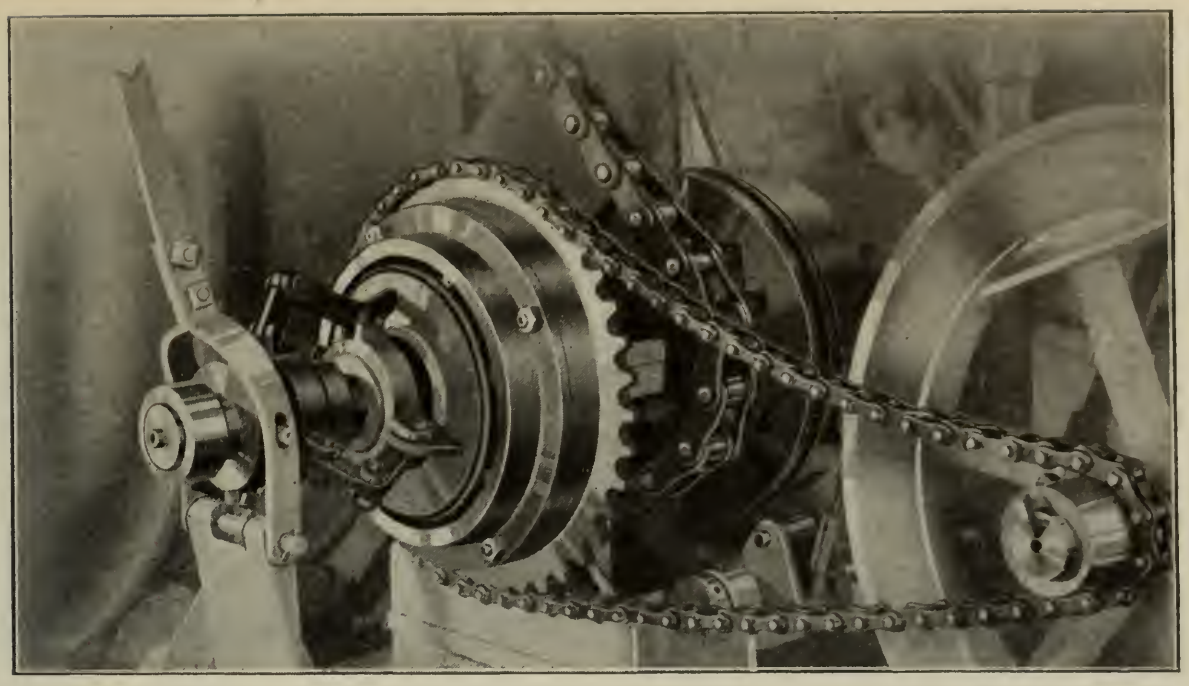
## A General Purpose Mixer

*By C. R. Meyer, C. R. Meyer & Sons, Contractors, Oshkosh, Wis.*

We are not only one of the oldest firms in this section of the country, but were among the first to make use of concrete mixing machinery. As we had always been in the market for any kind of machinery which would lower our operating costs, we saw in the concrete mixer a great labor-saving possibility, and were not slow in testing same on our work. The first mixers were, of course, crude affairs when compared with the machines of to-day, but we were able to save money thru their use, and did all in our power to encourage their manufacture.

We firmly believe that it pays the contractor to spend money for machinery which will enable him to cut his operating expenses and thus place himself in a position to bid successfully on large work yielding him a profit. This is most certainly an age of machinery and it is thru the purchasing and proper use of same that the contractor is enabled to offset constantly increasing material and labor costs. Labor costs are easily 33 1/3 per cent higher than ten years ago, and contractors would find public work almost profitless were they not in a position to cut operating costs by means of efficient machinery.

The concrete mixer has probably done



OSHKOSH MIXER, *single train driving mechanism and special multiple disc friction clutch.*

more to insure more satisfactory work for all concerned than any one machine, as it is used to a certain extent in almost every phase of public construction work. We have followed the growth of the mixer from the very beginning and have owned a machine typifying every stage of its evolution. Our latest purchase has been most satisfactory from the standpoint of accomplishment, as we can mix 290 batches in seven hours on rush work. It comprises several features which mean lower operating costs, as well as minimum maintenance expense. Inasmuch as it is exceedingly adaptable to all phases of contracting work, we are giving herewith a brief description of a few of its constructive features.

This chain drive mixer, which is made by the Oshkosh Manufacturing Company, Oshkosh, Wis., and which is furnished with steam engine, steam boiler, gasoline engine or electric motor, easily has the following capacities:

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of mixer..... | 5 | 10 | 20 | 30 | 40 | 60 |
| Capacity per batch in cubic feet of loose material ..... | 5 | 10 | 20 | 30 | 40 | 60 |
| Capacity per batch in cubic feet of mixed material ..... | 3½ | 7 | 14 | 21 | 28 | 42 |
| Capacity per hour in cubic yards with standard hopper.... | 4 | 8 | 16 | 24 | 32 | 48 |
| Capacity per hour in cubic yards with power loader..... | 8 | 16 | 32 | 48 | 64 | 96 |

The drum is made of steel and gray iron, ¾-inch thick, in two sections, which are bolted together at the flange on a machine joint, the roller tracks being cast in one part with the drum. Segmental sprockets are attached to the flanges in the center of the drum, thus assuring speedy repairs in case of accident, as only the two cap screws or bolts need be screwed up. Material does not clog or solidify in the drum, as it has no pockets or sharp angles. The corners of the drum are at least a 4-inch radius, which makes all material falling against the head flow toward the center. The mixer projections or blades are lifted high enough off the drum shell so that the water or any grouty concrete will flow under them and clean them at every batch.

The mixer projections are so shaped that they turn down and do not pick up the fast-moving concrete, and also so that they pick up the part of the mixture which has the least voids, or, in other words, which is the most solid. This is accomplished by forcing the mixing material into the vortex, which makes a solid mass (relatively solid), so that the lifting projections will lift it up to the discharge chute in one solid mass and not separate it in the discharging.

We were the first contractors to purchase this new machine, and the discharge chute was the one feature which appealed to us, as it gave still another motion to the mixing of the concrete. The chute proper is held and operated by a single yoke, which is keyed directly to an operating shaft at both ends. This makes it possible to discharge from either end or side of the mixer by simply transferring the operating lever.

Choking at the mouth of the hopper is prevented on account of the fact that its

length is such that the material spreads along its length while being hoisted, causing an easy flow of the advancing material in the spout into the drum before it has reached the absolute pouring position, thereby preventing choking at the mouth of the hopper. The batch hopper or power charger and standard charging hopper can be changed one for another in the field with ordinary tools, all parts being standardized and fitted to interchange.

Another feature of interest to contractors is the ease with which all parts can be interchanged on the job with ordinary tools. This machine has a special multiple disc friction clutch of fiber frictions or discs running between metal discs, which allows an easy, smooth-starting, positive-holding clutch, easily operated and easily adjusted.

and coal tar, carefully distilled and proportioned, which has been in successful use in New England roads for over ten years. It is applied by the mixing process and costs from 40 cents to $1 a square yard, the latter figure never having been exceeded. It is made in three grades; No. 1, for dust laying and blanket treatment, and Nos. 2 and 3, for macadam construction by the mixing method. The five-year guarantees given with each completed contract have always been safe propositions for the contractors, as the roads are reported as always outliving them.

Roads treated with the compound do not bleed, crawl or ravel, will stand the heaviest teaming and automobile traffic, are dustless if kept clean, and are maintained for one cent per yard per year. Ma-Drite is not patented and is therefore subject to no royalties.

MA-DRITE *Pavement, view of completed street.*

*Laying* MA-DRITE *Pavement.*

## Ma-Drite Bituminous Paving Compound

The problem in modern road construction is a compound for filling the voids and cementing together the stones in macadam wearing surfaces. Ma-Drite is a bituminous combination, made of asphalt

## Water-proofing Sewers

*By W. W. Dixon.*

Modern sanitary demands, including those of sewage disposal plants, make water-tight sewers imperative. G-K compound has been brought forth to meet these demands and has done so.

# Tarvia

*Preserves Roads*
*Prevents Dust*

Broadway, Norwich, Conn., Treated with "Tarvia B."

## A Dustless Thoroughfare

"TARVIA B" is a tar product which is liquid at normal temperatures and can be applied to the surface of a macadam road from a modified sprinkling cart, no other apparatus being necessary.

The usual procedure is to sweep the road of surface dust and dirt, apply the Tarvia B and keep the traffic away for a few hours until the Tarvia has penetrated into the road surface. This grade of Tarvia is used only on roads where the rolling effect of traffic has made the interstices between the stone very small; on this account a denser grade of bitumen would not do, because it could not percolate into so closely bonded a surface. Tarvia B, however, finds its way into such surfaces and forms a matrix, holding the fine screenings in position, preventing raveling and erosion, preventing the formation of dust by automobile traffic and greatly prolonging the life of the roadway.

A typical instance of the use of Tarvia B is in Norwich, Conn., Mr. E. C. Lillibridge, the Street Commissioner there, wrote as follows:

November 15, 1912

"You ask for my opinion concerning Tarvia B to which I will say I do not believe it has any equal. We have used this material for three years and the more it is used, the better satisfaction it gives, as to preserving the road and lasting longer. We have the last year used this material on two miles of streets and today those streets are in excellent condition after the traffic of heavy teams and autos"

In addition to Tarvia B there is Tarvia A for hot surface application and Tarvia X for road construction.

Booklets sent free on request.

BARRETT MANUFACTURING COMPANY

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TRADE B MARK

The plastic nature of the compound originally sold as "dip," and since known as G-K by copyright, was first noted in 1909 by John S. Stiger, late city engineer of Summit, N. J., and he directed that a joint be made with the material. Record of the test was published in October, 1910, and the material was specified and used in several sewers built in 1910 and 1911 by the city of Summit. Other engineers investigated and found this use economical, although the composition was more expensive than cement and sand.

G-K sewer joint compound is the result of several years of chemical experimentation and is a chemical compound, not a mere mechanical mixture. It is a combination of vulcanized linseed oil and anhydrous clay, the vulcanization being covered by many letters patent.

The claims of the manufacturers are for a sanitary, water-tight sewer, and flexible joints, which make the sewer sanitary and reduce to a minimum danger of breakage of pipes due to heavy backfill or soft subgrade or other cause for movement of the completed sewer line. The use of G-K compound in wet trench work is a great saving, as in hardening it shows no appreciable shrinkage, checks or cracks and so it is absolutely impossible for roots to penetrate. The following letter, written at an editor's request by Julius Keller Construction Co., Indianapolis, and not to me, shows a source of saving to the contractor:

"The sewer was to be laid in a water-bearing gravel and sand soil, specifications calling for a water-tight sewer on completion, and the jointing medium to be (a sewer joint compound on the market). Encountered water very close to surface, necessitating close sheathing. We found it practically impossible with steam pumps, working day and night, to reduce the water level so that we could use (that compound) and make a joint that was at all satisfactory to ourselves and engineer. We then used G-K and made perfect joints in the presence of quantities of water, and discarded the pumps."

Regarding flexibility, the following quotation from the same letter is conclusive:

"A very interesting and curious condition was met with on one occasion, to-wit: A section of sewer 12 inches in diameter, 64 feet in all, was laid and joined with G-K compound, and before any backfill had been commenced we had a heavy rain for several hours, filling trench to surface. When water was removed it was found that gravel and soil had washed under the pipe and had caused the line to bow upward until it was washed out of grade 14 inches in center. In spite of this, the section of sewer was tight. This flexibility we consider a truly wonderful example of the G-K compound from an engineering standpoint."

In practice the compound is heated in a heavy shallow iron pot rather than one of the lead pot variety and is heated to a temperature of 350 to 400 degrees. At this temperature the material is as fluid as water. The joint is first packed with oakum, after which an asbestos runner is placed around the bell and the joint is poured a little off center. The compound filling the annular space runs completely around the pipe, reappearing at the top of the other side. This process was successful in 48-inch reinforced concrete pipe, poured 3 inches off center.

The compound makes an absolute bond with tile of the highest glaze. Bond, flexibility, freedom from cracks or checks, and complete filling of annular space give joints absolutely water-tight with any possible deflection, expansion or contraction in a sewer pipe line.

Infiltration of water at dead ends and branch connections is prevented by a specification that "the vitrified stopper shall be set in openings of branches and a sufficient quantity of G-K compound poured in the inner circumference of the bell to tightly seal it." When necessary to complete the house connection, a small piece of waste or paper burned under the end of the pipe will soften the compound so that the stopper can be removed without danger of breaking.

It is not unusual to find sewers laid with ordinary joints showing infiltration of 25,000 to 50,000 gallons per sewer mile per day and amounts of 250,000 and 500,000 are well authenticated. Leakage of sewage into dry soils is just as likely and will pollute water supplies drawn from water levels below. It costs money to pump infiltration water and to treat it in sewage disposal plants, so that in either case economy demands water-tight joints.

L. W. Freeman, assistant engineer of Borough of Richmond, New York City, reports test of section of 15-inch vitrified pipe sewer with G-K compound in joints of only 450 gallons per sewer mile per day after immersion six days under 5-foot head. E. C. Catley, resident engineer for Alexander Potter, reports results of tests on South Orange, N. J., on short sewer lines with G-K compound in joints under internal and again external hydrostatic pressure of 5 feet finding them absolutely tight. The completed Hilton section showed about 400 gallons infiltration per sewer mile per day. Mr. Catley terms this very small for a sewer system of 3.53 miles of pipe, half below ground level and some under ground water head of 3 feet.

# MUNICIPAL ENGINEERING

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**Municipal Engineering** Main Office **Indianapolis, Ind.**

Western Office: 1945 Commercial Nat'l Bank Bldg., Chicago
Eastern Office: 1125 World Bldg., New York City

Increase of sewer sizes 20 to 33 per cent. to take care of infiltration is evidently unnecessary if G-K compound is used and that expense is saved.

## The Northfield Mixer

The Northfield mixer is a very lightweight and substantially built and convenient machine which is coming into popular use on both large and small work in the municipal contracting field.

August Sahlberg, clerk of Stockholm township, Cokato, Minn., states: "With the Northfield two men can easily do all the mixing as fast as a third man can wheel the gravel. I always place the mixer so as to dump the concrete directly in the forms. The machine is light enough to be easily moved by two men. The speed or capacity is generally regulated by the men wheeling in the gravel. On ordinary bridge work, where the gravel has to be moved from 25 to 50 feet, and the water and the cement cannot be placed near enough to be real handy, I find that three men do the most uniform work and will average about 3 cubic yards per hour. If everything is real handy, a batch per minute can be mixed, but a wall will grow so fast at this rate that the machine will soon be too far away from the gravel and water, etc., to continue at any such speeed. Three men around the mixer will keep me busy building forms. I have averaged 30 cubic feet per day on big jobs without any rush, and persons familiar with hand-mixing can figure out what a saving that means. I built two concrete arches of exactly the same size and with the same crew, one before getting the mixer and one after, and found that there was a saving of 2½ days' time by the crew of four men. The digging and other preparing required exactly the same time in both places. It is so compact and requires such small space that it can always be placed so as to dump the batch directly into forms, without second handling or transportation.

"When operated by hand power the discharge is completely automatic, for all that is required is to reverse the motion on the cranks and the drum is instantaneously dumped; requiring less than a second to accomplish this feat, and then by reversing the motion on the cranks again is instantly swept out clean, and the righting of the drum to charging position is then also semi-automatic. But slight assistance by the hand is required to turn it over into place, as the motion of the mixing shaft has a tendency to lift it back again, and at times it will accomplish this feat automatically, without the operator assisting with his hand at all. The drum has a convenient locking device for holding it securely in the charging position, which can be used or not, just as the operator finds it most convenient. The drum can never dump of its own accord when the mixing is going on, and this locking device is seldom used except to back up or leave the drum full of mixture for a time.

"It has been found from careful observation on regular work that an ordinary crew of workmen turn the crank on this mixer a trifle faster than one turn per second. Not over thirty turns are required to thoroly mix mortar or concrete after the drum is charged. And it requires not to exceed three to five seconds to dump the batch, and about the same time to right the drum again for receiving the next batch. Charging never requires over fifteen or twenty seconds, so that with two steady workmen at the cranks, who attend to pouring in the water and cement and discharging the batch, and with enough wheelers to keep the mixer recharged without delays, there is absolutely no trouble to average a batch per minute with this machine, when mixing wet or slush concrete."

*The Hand Power Northfield Mixer.*

This mixer is manufactured by the Northfield Iron Company, Northfield, Minn., and Mr. C. L. Brown, of this concern, states:

"We guarantee the Northfield, on slush concrete work, under favorable conditions, to be full rated capacity, as shown by the table below. This capacity is conservatively based on careful observations taken from results obtained with machines that were in actual use on various construction jobs, and with ordinary workmen, instructions for operating being carefully followed. The minimum yardage is based on batches charged with 3-foot barrows, and the maximum yardage is based on batches charged with 4-foot barrows, and assuming that conditions are so favorable

# Coldwell Lawn Mowers

*Coldwell Motor Lawn Mowers on the Tennis Courts, Prospect Park, Brooklyn, N. Y.*

MORE than 600 Coldwell Motor Lawn Mowers are in use today at Golf and Tennis Clubs, on U. S. Government reservations, and in public and private parks.

A Coldwell Motor Mower is the best and most economical mower made for use on large lawns. Saves the expense of three horses and two men. Simple in construction, powerful, and strongly built.

The Coldwell Company makes the most serviceable and complete line of lawn mowers on the market — hand mowers of all kinds, as well as horse and motor mowers.

Whatever style of lawn mower you require, there is a "Coldwell" that just fits the need.

**If you are interested in the care of lawns, write for our illustrated booklet, mailed with catalogue on request.**

COLDWELL LAWN MOWER CO.

Philadelphia NEWBURGH, N. Y. Chicago

that each wheeler can load and wheel up and dump his barrow into the mixer drum every two minutes, and that these laborers be paid 25 cents per hour for a ten-hour day, batches to be discharged directly into forms:

| Size of Crew. | Safe Average Time per Batch. | Average Cubic Yards. | Average Cost Per Cubic Yard |
|---|---|---|---|
| 2 men | 3 min. | 20 to 27 yds. | 25 to 18½ cents |
| 3 men | 2¼ min. | 30 to 40 yds. | 25 to 18½ cents |
| 4 men | 1½ min. | 45 to 60 yds. | 22 to 17 cents |
| 5 men | 1 min. | 67 to 90 yds. | 19 to 14 cents |

"If the mixer is operated with gasoline engine or motor instead of by hand, a saving of practically one man's time can be made on the above schedule. We furnish the mixer all rigged with extra shafting, gear and belt pulley for running by power at a slight additional charge. In operating with five men, as shown above, the fifth man helps shovel and unties the sacks of cement, attends to water barrel, etc. If conditions are not favorable you may not be able to mix more than one-half the above rated capacity, but, even so, the Northfield will mix faster than the majority."

## Ornamental Lighting in Topeka, Kan.

*By A. R. Young, City Engineer.*

We have 157 ornamental lighting poles in service in fifteen blocks, having installed 108 in the year 1911 and 49 in the year 1912.

This method of lighting has proven very satisfactory and it is our intention to make further additions to the system in the very near future.

Each pole is equipped with 10-k.-w., 2,200-110-volt single phase transformers connected for two-wire 110-volt distribution. Transformer poles are equipped with moisture-proof metal cabinets accommodating four 61-100-ampere and two 1-30-ampere cut-outs, also one double-pole solenoid-operated switch for a.c., 110-volts, 60-cycle, 100-ampere. The blades of this switch are connected so as to operate as a separate or independent single-pole switch, and one of the 61-100-ampere cut-outs is installed between the transformer and the switch. All cut-outs are of the 250-volt enclosed type, each 61-100-ampere cut-out fused at 75 amperes, and the 1-30 fused at 20 amperes. The style of wiring from the pole cabinet is such that the solenoid switch controls the four-arm lights of all poles and the top light is independent.

All wires and cables are installed in conduits, which are lead covered and insulated with varnished cambric. All wires in lamp columns are No. 12 rubber covered. No. 6 cables are looped into the Edison cut-out in base of poles. At all connections in lamp posts the lead cable is looped to such a height that all taps are 6 inches above sidewalk level. All cable splices are protected by a lead sleeve large enough to allow for a sufficient amount of varnished cambric tape to properly insulate the joint. Conduits are bituminized fibre as manufactured by the American Conduit Co., and are incased in concrete with a covering of 3 inches on all sides.

The posts are wired so that the solenoid switch will turn off the arm lights and leave the top light burning. All posts are fitted with Edison plug cut-out No. 8042 in the base of pole and fused at 6 amperes. Access to this cut-out is thru a door in base of pole, which is fitted with a lock and key. All posts are fitted with lamp sockets manufactured by Pass and Seymour, No. 423 globe holders, globes and 108-volt 100-watt regular Mazda lamps. Globes are thin and white. Arm globes are 12 and top globes are 16 inches. All poles are bolted to a concrete base.

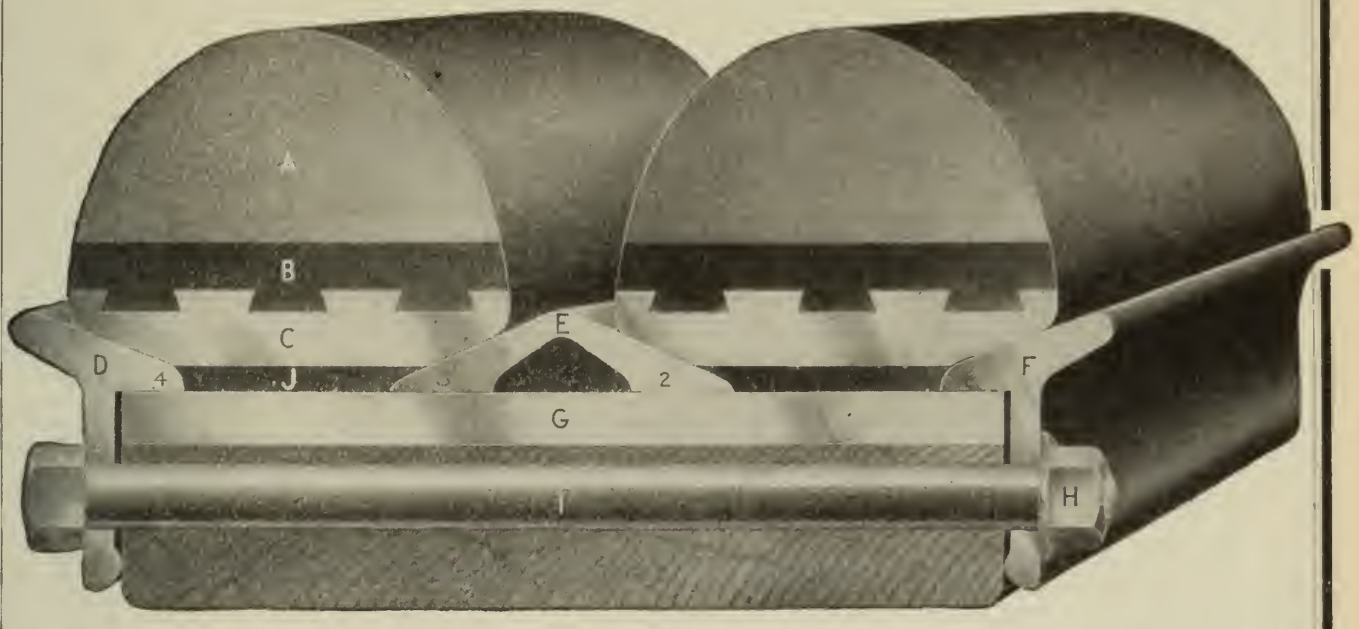
Our ornamental lighting system is not only a source of great pride to our citicens, but also receives the highest commendation from outside engineers. Our ornamental "De Lux" standards are made by the King Foundry Co., St. Joseph, Mo., of special blended iron and steel. The city of Topeka assumes maintenance and current expense. The total expense per block is about $200.00. Initial cost per running foot ranges from $1.60 to $2.25. The average annual cost for renewals on account of globe breakage is $1.08.

## Kentwood, La., Pumping Plant

*By George F. Conant, Engineer in Charge.*

The pumping machinery installed in the Kentwood plant is a combination city water works system for domestic and fire service. The pumps meet all the requirements of the fire underwriters. The small engine and air compressor supply compressed air for instantly starting either or both of the pumping units. This is an exceptional installation inasmuch as fire pumps are not usually operated by oil en-

# Tires of Guaranteed Efficiency for Municipal Service




United States Standard Demountable Tires have the well-earned distinction of being the most efficient motor truck tires on the market today.

This is an important statement to every municipal department man who has a haulage problem on his hands.

Efficiency is the watchword of the modern business and mechanical world today. The departments which are making the best showings are the departments that have come the closest to making every man, machine and appliance throughout the organization 100 per cent efficient.

Clearly this rule applies to the delivery and haulage departments as well as to any other branch of work.

If you are compelled periodically to lay up your trucks and tie up your deliveries hours or days at a time while a wheel is away at some distant repair station for a tire replacement, you have a weak, inefficient spot in your delivery system that would not be tolerated a day if it occurred in a modern manufacturing plant.

## UNITED STATES STANDARD MOTOR TRUCK TIRES

(DEMOUNTABLE)

have forever done away with inefficiency of this sort.

Here is a tire that can be replaced in the garage by the driver himself after working hours. And it will take him only fifteen minutes to do the job (even for dual equipment).

Expensive, troublesome, repair shop delays are a thing of the past. Carry a spare tire on your truck and you are independent.

Furthermore, United States Tires bear an unprecedented

## GUARANTEE for 10,000 miles of service

(conditional upon its being used in one year's time.)

That will enable you to put your trucks on a lower cost per mile of service than you have ever been able to do before.

From the standpoint of both **time** saving and **money** saving, United States Standard Tires are well nigh 100 per cent efficient.

## UNITED STATES TIRE COMPANY

NEW YORK.

gines, and special specifications were drawn up and submitted to the Louisiana State Board to cover the situation.

Our machinery consists of one 60-h. p. Fairbanks-Morse oil engine, direct connected by Eclipse friction clutch to 7x12 Fairbanks-Morse duplex plunger and ring pattern power pump, and one 80-h. p. Fairbanks-Morse oil engine, direct connected by Eclipse friction clutch to 9x12 Fairbanks-Morse duplex plunger and ring pattern pump. It is my opinion that for plants of our size, the cost of operating an oil engine is considerably less than steam on account of decreased cost of fuel. Then when fuel is only required when plant is in actual operation, there is absolutely no waste. Such a plant is always ready for instantaneous service and there is no delay on account of low steam pressure, for firing up boilers. The cost of operating such an engine is in direct proportion to the amount of work done and there are no costs piling up when the plant is not running.

Our well is 727 feet in depth and has a natural flow of over 500 gallons per minute. Our concrete reservoir has a capacity of 125,000 gallons filled by flow from well, the surplus overflowing thru a pipe at the top and just beneath the roof.

Our 60 h. p. engine is directly connected with a 500-gallon-per-minute pump and our 80-h. p. engine is directly connected with a 750-gallon-per-minute pump. The former engine uses nearly 6 gallons of oil per hour and the latter about 8 gallons, pumping direct from the concrete reservoir into an elevated steel tank against a head of 185 feet which gives sufficient pressure for fire purposes.

Our plant is operating very successfully and we believe at a minimum expense.

## Uniform Pressure Flusher

The Etnyre uniform pressure flusher is equipped with a two-cycle, air-cooled motor, directly connected with a powerful centrifugal pump and mounted on the same base. It is suspended from the steel frame at the rear of the wagon, and, in operation, produces a uniform pressure on the flushing nozzles from the first to the last gallon of water in the tank. The pressure can be reduced to any desired amount instantly at the will of the operator by the use of the controlling foot levers.

The engine is provided with an automatic governor, so that it cannot race when running idle, and a switch connection with the driver's seat permits of its being stopped instantly. The motor is of the most simple and durable construction and can be operated by any ordinary workman, and is started by turning flywheel one-quarter turn in either direction. The flushing nozzles are set low and can be turned at any desired angle to obtain the best results. The tank is made of heavy steel, and is provided with manhole and hose connections, as well as separate opening for filling from standpipe. The tanks on this flusher can be filled more quickly than in other types, as the water does not have to run against pressure.

The standard tank has a capacity of 600 gallons, and is made of 12-gauge galvanized steel. These machines may also be equipped with a pressure sprinkling device as well as with hose and connections for filling tank with the motor and pump at the rate of 250 to 300 gallons per minute, at a raise of from 20 to 25 feet.

E. D. Etnyre & Co., Oregon, Ill., make these machines, as well as a complete line of motor truck sprinklers and flushers of both gravity and pressure types.

## The Monahan Trench Digger

The view, shown herewith, illustrates the manner in which, in cutting the bottom of a trench, the buckets on the Monahan trench digger actually do the work, instead of the back pans, as is the case on many other machines.

These buckets are 28 inches apart and are built in sizes from 24 to 48 inches wide, by 10 inches deep. They are held on the chain by two arms attached to the link ahead, so as to give bucket an opening of 72 degrees at the dumping end. Each bucket is fastened to the arms by two ⅝-inch cotter pins, which shear off when a sudden obstruction is encountered, thus avoiding damage to the machine. The digging teeth are set in cast pockets and consist of one piece of 1½x1-inch tool steel, and are held in place by cotter pins, which simply prevent the tooth from falling out, but do not sustain any part of resistance in digging.

These machines were designed by a mechanical engineer, who received his knowledge of trench digging and sewer contractors' requirements by actually being engaged in that business.

The Monahan trench digger is equipped with a 45-h.p. self-propelling engine. Three jaw clutches control the entire operation of the machine, including traction.

On traction there is a direct drive to the back traction wheel, which is 54 inches in diameter and 48 inches in width. An open steel gear of 4-inch pitch eliminates the necessity of a differential, which usually weighs from 1,000 to 1,500 pounds, is difficult to properly lubricate and subject to constant wear.

But two men are required to operate these machines, which are made by Wm. Heggie, of Joliet, Ill.

# The Telescope of Speech

The astronomer, by the power of his telescope, becomes a reporter of the movements of a hundred worlds greater than ours, and the student of celestial activities millions of miles away.

He points his instrument at any spot in the heavens, and his sight goes rushing through space to discover and inspect a star hitherto unknown.

Up to the power of his lenses, his vision sweeps the universe.

As the telescope may be focused upon any star, so the telephone may be focused upon any person within the range of its carrying power.

Your voice may be directed anywhere in the Bell System, and it will be carried across country at lightning speed, to be recognized and answered.

The telescope is for a very limited class, the astronomers. The telephone is for everyone.

At the telescope you may see, but cannot be seen. At the telephone you may speak and be spoken to, you may hear and be heard. By means of the Bell System this responsive service is extended to the whole nation.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

*One Policy* *One System* *Universal Service*

## Trade Publications

The Sandusky Portland Cement Co. has issued a handsome booklet devoted to Medusa waterproofing for making concrete water-tight. It is well worth asking for as it is full of valuable information.

The Texas Company discontinues its house organ, entitled "Paving and Roads," and will issue occasional bulletins on the subject.

The fourth annual Public Service Corporation Review will be published by *The Financial World*, 18 Broadway, New York City, on April 26.

The Fred Medart Mfg. Co., Dekalb and President streets, St. Louis, Mo., issues "The Story of My Ideal Playground," written by a playground committeeman.

A booklet has been issued by the Cameron Septic Tank Co., Chicago, Ill., explaining its position in septic process patent legislation, particularly with reference to the Knoxville, Iowa, case.

The National Tube Company's "Book of Standards" is a 600-page handbook of detailed and accurate information on air, gas, water and steam transmission in pipes. It is well worth the $2 asked by the company, 1106 Frick building, Pittsburg, Pa.

The National Fire Proofing Co. has issued a catalog showing the Natco imperishable silo.

The Universal Portland Cement Co. issues a valuable booklet on "Concreting in Cold Weather," with special reference to the needs of the farmer and small town contractor, which will be sent on request sent to 72 West Adams street, Chicago.

The Current o' Scope shows in a simple and correct manner how the so-called revolving field is produced by the action of alternating currents in a 3-phase alternating current induction motor. It is mounted on a card and the turning disc shows the changing conditions. For 25 cents it will be sent by Fairbanks, Morse & Co., Chicago, Ill.

Catalog 805 of Studebaker, South Bend, Ind., is devoted to Studebaker dump wagons, and shows details of all parts and the advantages they have.

Bulletin 46 of the Jeffrey Mfg. Co., Columbus, O., describes the Jeffrey swing hammer pulverizer for laboratory use in reducing many kinds of materials.

The Sherman equal heat gas burner is shown in a booklet of the Sherman Mfg. Co., Detroit, Mich.

The Buffalo Pitts Co., Buffalo, N. Y., issues a fully illustrated catalog of its special hauling machinery for road building purposes and the like.

The National Police Signal Co., Buffalo, N. Y., issues a booklet descriptive of its police signal systems.

## Trade Notes

Manning, Maxwell & Moore, 85-87-89 Liberty street, New York City, have taken the agency for the Chain Belt concrete mixer, concrete elevator, spouts and other concrete machinery manufactured by the Chain Belt Company, Milwaukee, Wis.

A contract for standard Raymond concrete piles, to support the reinforced concrete arch over Gallagher's Gulch, Tacoma, Wash., has been awarded to the Raymond Concrete Pile Company, thru their northwestern office at Portland, Ore. W. C. Raleigh is city engineer of Tacoma.

Elastite paving joint, manufactured by the Philip Carey Company, Lockland, Cincinnati, O., has been installed for experimental purposes on Garden street, between Green and Walnut streets, Louisville, Ky. It has been in use in street pavements in Bloomington and Richmond, Ind., for some time, and its use is rapidly extending.

The Chatfield & Woods Company, Cincinnati, O., wants a second hand road roller, gasoline motor preferred.

The H. W. Johns-Manville Company announce the removal of their Newark office to 239 Halsey street. Their new office and salesroom is located on the ground floor for J-M asbestos roofings, packings and pipe coverings, brake lining and auto accessories, "Noark" fuses and protective devices, Frink lighting fixtures, etc. The company have opened a branch office in the Dooly block, Salt Lake City, to take care of their rapidly increasing business.

The Ceresit Waterproofing Co., Chicago, have established a department of superintendence and put it in charge of John J. Lyons, who will provide for the superintendence of the use of their waterproofing when engineers or architects desire a check on contractors for such work, in which case the company can give a bond of guarantee.

The American Water Works & Guarantee Company, of Pittsburg, Pa., has awarded contract to the Epping-Carpenter Company, of Pittsburg, for the construction of a seven-million-gallon vertical triple expansion condensing pumping engine, to be installed at their plant at Chattanooga, Tenn.

The office and factory of the Union Clay Products Co., makers of G-K sewer joint compound, are now at 14-20 Water street, New Brunswick, N. J., with greater facilities for quick dispatch of orders.

John Baker, Jr., 332 South Michigan avenue, Chicago, has added to Texaco asphalt, which he has heretofore handled, the well-known Star brand of California asphalt made by the Standard Oil Co. Fluxes and road oils are included in both lines.

# MUNICIPAL ENGINEERING

**The World's Leading Municipal Publication.**

CONSTRUCTING *a modern highway, Farr Bros., Chicago, Contractors.*

VOL. XLIV. APRIL, 1913. No. 4.

*Staff organization, as defined by Mr. Harrington Emerson, is that part of organization machinery which brings ideas and plans to the corporation from outside sources. From such information new methods and higher efficiency are instituted.*

*It is the function of this publication to act as the staff organization for its thousands of subscribers, to place before them new ideas, and to give them information from all parts of the country that will be adaptable to their business in the promotion of higher efficiency.*

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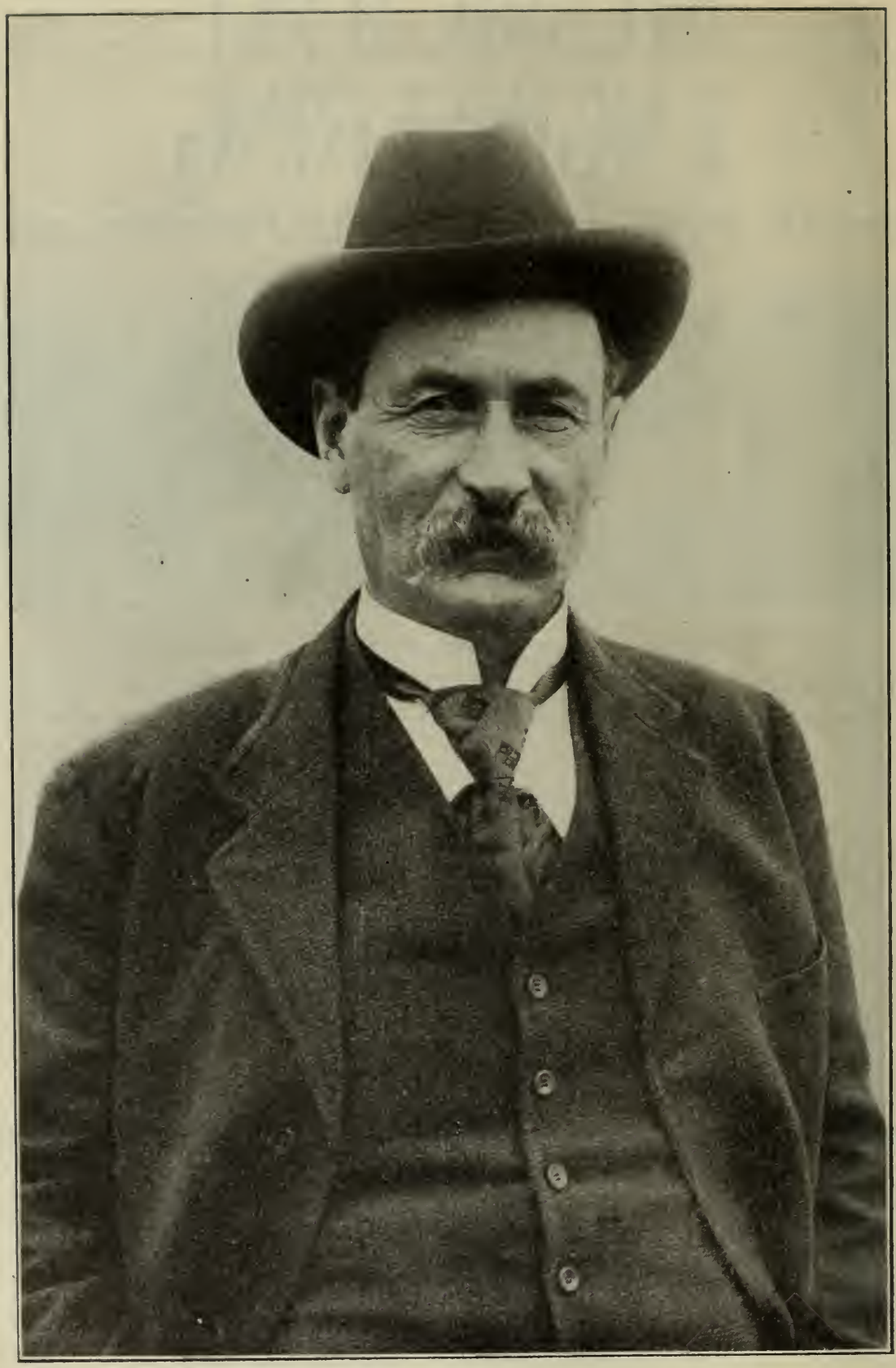


WILLIAM MULHOLLAND, *Chief Engineer of the aqueduct, in a characteristic attitude.*

# COMPLETION OF THE LOS ANGELES AQUEDUCT

*By Burt A. Heinly, Los Angeles Water Department.*

*The completion of the great Los Angeles aqueduct almost simultaneously with the publication of this number of* MUNICIPAL ENGINEERING, *makes this article by a member of the official family of the Bureau of Water Works and Supply of the Los Angeles Department of Public Service very timely and the collection of photographs of various features of the work most interesting. The "Big Chief" is caught in a characteristic attitude and the "Big Ditch" is shown in its magnitude and the dignity, beauty, and magnificence of its surroundings. The views show as well the enormous difficulties that were met, the natural obstacles of desert, mountain and canon which were overcome, and give some hints of the ingenious and marvelous methods used in this beneficial application of science to the control of the forces of nature, which is engineering in the highest meaning of that term.*

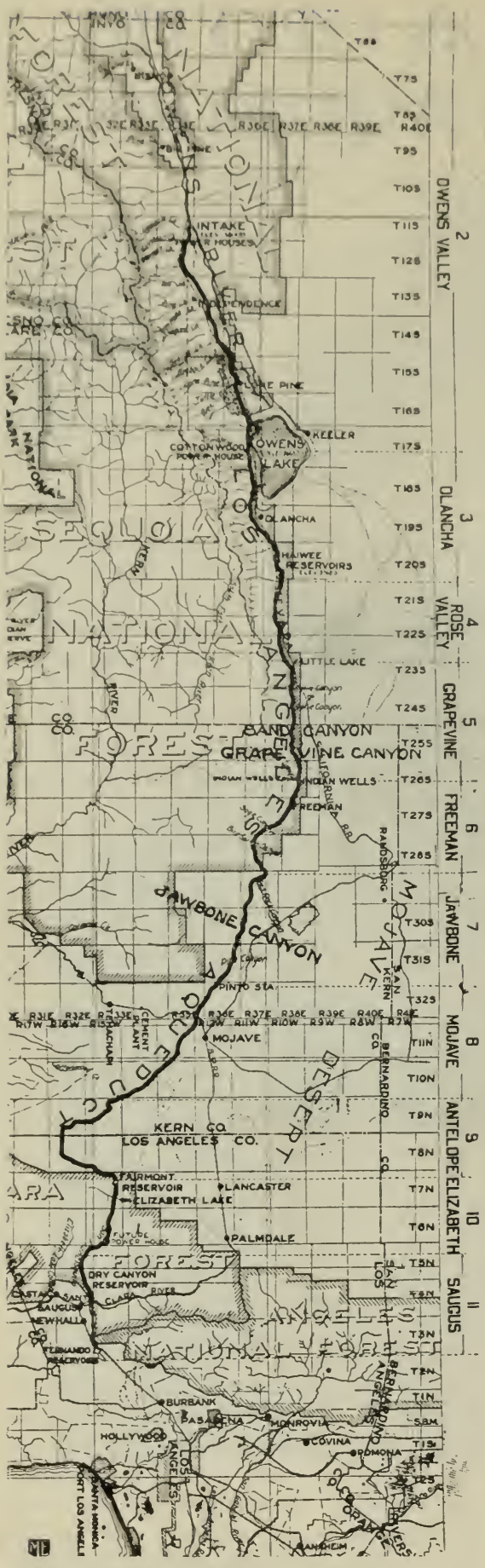
SOUTHERN California is topographically a country of rough contours and steep gradients, or slopes, and this condition would be considered, ordinarily, as the least favorable for retention of the flood water of the higher altitudes, but curiously, the very violence of the action induced by these steep slopes on the falling waters tends to supply the medium by which they are retained.

THE JAWBONE SIPHON. *Note sections of pipe in valley and railroad alongside pipe line, with car in bottom of valley loaded with section of pipe.*

Our higher mountains are mainly composed of granite of a coarsely crystaline structure which is readily fractured by variations of temperature on its surface. The fragments so produced are washed down in large volume and spread out in great delta fans in the valleys and these deposits are so porous in their nature as to afford incredible space for the reception of water. These fragmental deposits, notwithstanding their great porosity, offer such resistance to the free flow of water sinking into them that they prevent its rapid escape down the slope. Indeed, it is a common thing to find slopes in these gravel-contained waters as steep as from forty to fifty feet to the mile and yet the velocity of the water as measured by the observed discharge from them may be as low as eight to twelve feet per day.

It is due to these agencies that the very irregular precipitation, which in an average year does not exceed 15.6 inches and ninety-six per cent. of which falls from October 1 to April 30, is regulated so as to afford a fairly even and reliable water supply.

The water so conserved in gravels and sands is naturally held under the most favorable conditions, not only for the prevention of loss thru evaporation, but also for the preservation of its purity, as it is fully protected from surface contamination. In point of fact, in addition to its function as a reservoir, the great mass of detritus acts as a most effective and complete filter.




*Map of the Los Angeles Aqueduct.*

### Underground Supply Dwindles

During the winter of 1897-98 we experienced the first seven successive years of scanty rainfall. In the year following the streams began to dwindle in size. Forthwith began the erection of steam pumping plants to make up the deficiency from the underground reservoirs such as I have just described. Finding that this was a cheap, efficient and dependable source of supply, the Californian, no less avaricious than any other average man, provided water not only for his lands then under cultivation but extended his ditches and ran the water from this source farther and farther into the dry lands. The gasoline pumping engine, too, played a most important part in this development. The invention had just been

A SIPHON LINE *under construction. Note the sections in the foreground ready to adjust and rivet to the line.*

made a commercial success and California irrigators were among the first to seize upon the idea. The farmer could start the engine in the morning, then go about his work, and all day long a sparkling stream poured into the irrigation ditches. Wells were put down by the hundred.

Since the founding of the pueblo in 1781 by the Mission Fathers, Los Angeles has taken her domestic water supply from the Los Angeles river—a stream that rises in the southern slopes of the Sierra Madres, flows in a southerly direction thru the San Fernando Valley and when in flood reaches the ocean. At other times the surface flow of this river is

RECTANGULAR SECTION OF CONDUIT *under construction on the Mojave division. Placing concrete on the forms for the roof. There are ninety-eight miles of this class of work.*

wholly diverted into the intakes of the city water system and from the city to the sea the river's course becomes a dry and sandy wash.

In the early days of the pueblo, there was water for all from the Rio Porciungula, as the river was then called, but little by little the pueblo grew from a village into a town and into a thriving city. By degrees the land which had been submerged became urban and in the same territory where once the water was devoted to irrigation it was now taken for domestic use until the whole surface flow of the stream was passing into the city's pipe system.

The seven years of drouth affected the flow of the Los Angeles river in the same way that it did all other streams of the Pacific coastal plain, and the city, just as the irrigators were doing, began the development of an additional supply from the subterranean flow of the river. Galleries were driven in the water bearing gravels at right angles to this flow. The city's supply was considerably enlarged thereby, for a time.

The painstaking investigation of our underground water supply which the United States Government Reclamation Service conducted proved the shrinkage by the inroads made upon it. The city had abundant evidence of the conditions by the gradual diminution of the flow in the Los Angeles river.

The city in 1902 was consuming about 23,000,000 gallons daily. Even with the reduction of waste this had increased in 1905 to 30,000,000 gallons. With the fullest possible development of the surface and subterranean flow of the river we could not hope to procure more than 50,000,000 gallons daily under normal conditions and this would shrink to smaller limits in cycles of dry years. It was inevitable that the city would expand. Not only was its population going to become more dense within the limits that then existed but the limits were going to be extended widely.

### Municipal Ownership Begins

Los Angeles began the municipal ownership and operation of its water works in February, 1902, and almost immediately the search was begun for a supplementary medium of supply. All possible sources along the coastal plain to the south were examined. All were rejected. The water of every stream was already appropriated. Every one was serving a purpose of the highest importance in nourishing and supplying valued improvements consisting of towns and orchards. Even had it been possible, it was not desirable to condemn these water supplies and reservoirs and restore to

STEAM SHOVEL, *with extra long boom, on open conduit. Olancha division, near Owens Lake.*

desert conditions the lands that were cultivated and improved and that served to aid the city's wealth and prosperity.

### New Supply Found

But far to the northward there was a place where water was going to waste—rolling by thousands of inches into a saline lake to be evaporated by the desiccating winds of the desert and to be lost to humanity forever. To this new source the city of Los Angeles has gone not only for water at present demanded but for the wealth that this new supply will bring in power development and in irrigation along the coastal plain.

The obstacles presenting themselves might well have daunted a city of even greater courage than this metropolis of the Southwest. A mountain wall intervened and beyond lay 150 miles of inhospitable desert shut in by bare and forbidding mountain ranges. The point on the Owens river in Inyo county, California, where the first surveyor's stakes were placed for intake of the proposed aqueduct is 250 miles distant.

Los Angeles undertook the task of constructing this great water conduit because she had no other alternative. That was seven years ago. Almost simultaneously with the publication of this article the waters of the Owens river and tributary streams flowing down the eastern face of the Sierra will be sweeping thru the long steel and concrete water course to the impounding reservoir at the head of the San Fernando Valley, 20 miles from the city's gates, and from here plans for one of the projected pipe lines are now being completed to carry a copious supply into the municipal distributing system.

### Owens River Water Taken

The Owens river has its head waters in the High Sierra not far from Yosemite Park and flows southward thru the Owens Valley to empty into saline Owens Lake. Its drainage area of 3,000 miles of rugged, snow-capped granite mountains affords a sure and copious water supply of which there need never be any fear of human contamination. From this river and the many streams that debouch from the Sierra for 50 miles along the course of the aqueduct, Los Angeles is preparing to take a supply, day in and day out, of 20,000 miner's inches or 258,000,000 gallons per twenty-four hours. Moreover by

ELIZABETH TUNNEL.
*Drilling back at the face, two miles in. Completed and lined tunnel section.*

the acquisition of 25,000 acres of artesian lands contiguous to the aqueduct and the river, the city is guarded against any possible period of long continued drouth by a reserve supply that can be developed to the extent of 10,000 miner's inches. In quality the aqueduct supply will have the same sparkling clearness and purity of

THE CEMENT PLANT *built to manufacture the cement for the aqueduct. This plant cost* $850,000 *and the city saved money by building it.*

the water now being served, but the mineral content will be only half that of the Los Angeles river, which approximates 30 grains to the U. S. gallon.

### Bonds Voted

In 1905 Los Angeles voted the first bond issue of $1,500,000 for the purchase of Owens river water rights and the preliminary engineering features of the undertaking. When the plans and estimates had been approved by a board of consulting engineers, comprising John R. Freeman, Frederic P. Stearns and James Dix Schuyler, the city voted an additional $23,000,000 for the completion of the work.

The $23,000,000 bond issue was authorized by the people June 13, 1907. Excavation of the Elizabeth tunnel, the 26,870-foot bore thru which the water is to be carried beneath the crest of the Sierra Madre range, was begun almost immediately afterwards, for at that time this was believed to be the dominating feature in determining the time of completion for the whole work. Other than this, no aqueduct excavation was attempted for a period of eighteen months. The whole

HYDRAULIC INTAKE GATES *by which water of Owens River is regulated in its passage into the aqueduct. The picture was taken upon completion of the gates, the river being walled off by a temporary dam.*

ROSE VALLEY *division construction camp. where mountains are as desolate as the desert and as far from civilization.*

GRAPE VINE CANYON. *Rectangular concrete aqueduct section. The steam shovel had to be taken apart and lifted up to the line, reassembled, and set to work.*

SAND CANYON *construction camp, typical of deep depressions on aqueduct line crossed by steel pipe line eight to eleven feet in diameter.*

JAWBONE SECTION, *Pickle Hills. The roads cost $5,000 per mile. This twenty-three miles is the roughest on the line and is nearly all in tunnel.*

energy of the organization then formed was devoted to the preliminaries of thoro preparation.

### Vast Preliminary Work

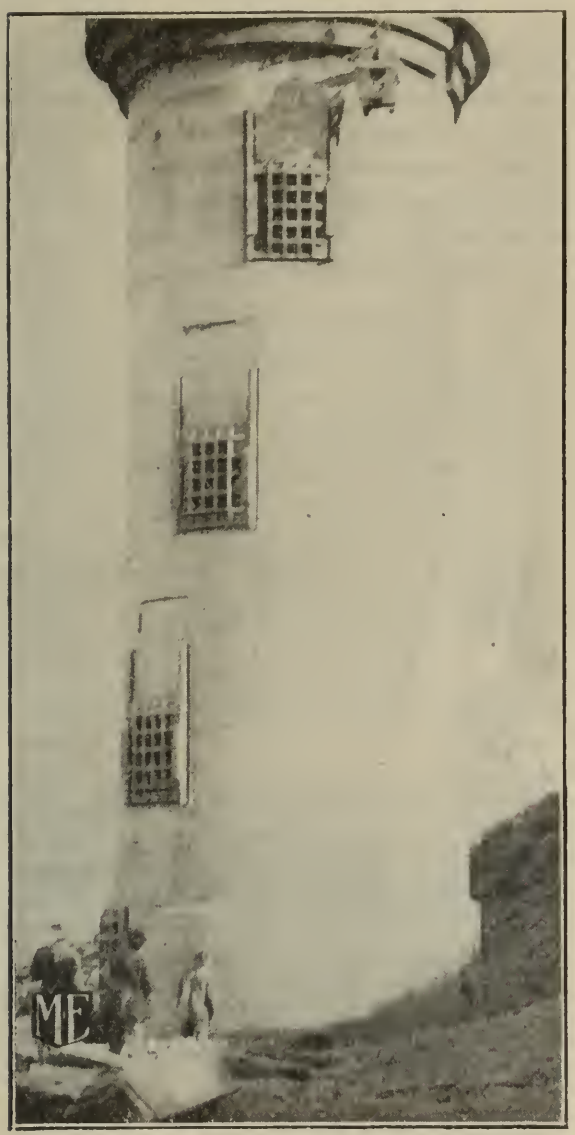
It is not my purpose to enter upon a detailed description of this phase of the undertaking, which of itself encompassed what has really been one of the most difficult phases of the work. Suffice it to say that the longer part of the aqueduct zone at the inauguration of the task was from 35 to 70 miles from any railroad. The best means of transportation and communication was a four-horse stage coach making tri-weekly journeys across the desert and connecting the town of Mojave on the Southern Pacific and Santa Fe railroads with Keeler, the terminus of the Colorado and Nevada narrow gage, near the mouth of the Owens Valley. Stage stations at twenty-mile intervals marked the only places of permanent human habitation along the 120 miles of trail. The city entered into a contract with the Southern Pacific Company for the construction and operation of a standard gage steam railroad to replace the stage coach and the corporation in 1907 began and carried to rapid completion this necessary improvement.

The city's forces busied themselves in the construction of 315 miles of roads and trails, and 150 miles of lines for the erection of a copper line telephone system from the central offices in Los Angeles to the most distant point of the work; the construction of three hydro-electric power plants on streams in the Owens Valley and a transmission line of high

voltage along the zone to transmit the energy for the lighting of camps and for driving the excavating machinery.

### Cement Plant Built

In addition the city undertook the manufacture of cement at a point adjacent to the line of the aqueduct and ex-



GATE HOUSE *in Haiwee Reservoir to regulate flow of water in the aqueduct to the south.*

pended $850,000 in this phase of the enterprise alone. It was a wise undertaking on the part of the Board of Public works for not only has the city been able to procure cement at a reduced rate but the work has not been delayed for lack of the material of which over one million barrels has already been required; large savings in freight have resulted and the Aqueduct Bureau has been enabled to

ELECTRIC SHOVEL *on Olancha division. Huge boulders made progress slow.*

carry on scientific investigations and adopt the use of tufa cement at large financial saving.

In the year and a half, hundreds of buildings required for the housing of men, animals and machinery went up as if by magic. All in all the city expended nearly $4,000,000 in the work of preparation.

### The Aqueduct

The Los Angeles aqueduct in its completed form comprises a proposed system of five storage and regulating reservoirs and 215.21 miles of conduit, exclusive of the 10.05 miles being constructed in San Francisquito canon for power development.

The aqueduct at the point where the flow of the Owens river is diverted into it has an elevation of 3,812 feet, and is a gravity system thruout. The river and the headgates are shown in two of the accompanying photographs. The first 21 miles consist of an open unlined canal having a width of 65 feet on the bottom. This canal, which follows nearly the general floor of the valley, has a capacity of 900 second feet and will carry not alone the waters of the river but will receive the flow of several of the river's tributaries and collect a quantity of the underground flow of the valley as well. A hydraulic dredge is shown in one photograph, excavating this canal.

### Open Ditch

At the toe of the Alabama Foothills the aqueduct assumes the form of a concrete-lined open ditch having a carrying capacity of 1,000 second feet to provide for additional stream diversions. This con-

MOUNT WHITNEY, 14,502 *feet high, in background. Alabama foothills and Lake Diaz.*

MOUNT WILLIAMSON, *back of Independence, and part of Sierra Range, forming water shed of Owens River.*

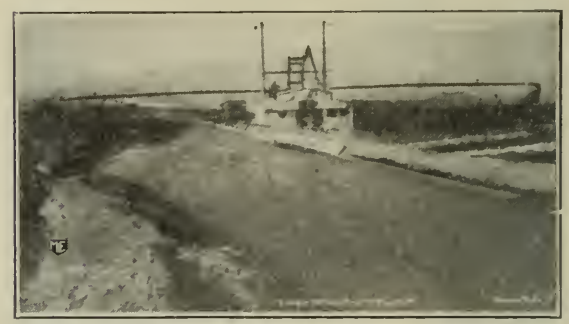
crete lined ditch will carry the water for 40 miles along the base of the Sierra and empty it into the Haiwee Reservoir. The character of the watershed is shown by two photographs taken along the canal. Haiwee basin, with a length of 7 miles, a maximum width of 1¼ miles and a capacity of 20,000,000,000 gallons provides not only for storage, clarification and effective sterilization, but it will regulate the flood waters to a uniform flow of 258,000,000 gallons per day thru the conduit to the southward. From this point on, the conduit is lined and covered with concrete. Its course for many miles lies high along the barren eastern face of the Sierra overlooking the Mojave desert, and here for mile on mile it assumes the form of concrete lined tunnel driven thru the solid rock. At many points the aqueduct zone lies 1,200 feet above the floor of the Mojave and where it has not been practicable to build roads, the materials and machinery necessary for construction have been hoisted into place by means of aerial trams.

### Inverted Siphons

Canons and gulches are crossed with inverted steel siphons, varying in diameter from 8½ to 11 feet. The head will range from 50 to 850 feet and the thickness of steel to safely withstand these pressures varies from ¼ inch to 1⅛ inches. Where the head is low and it can be done with safety, strongly reinforced concrete siphons take the place of steel. Photographs show some of these canons, two of them showing steel inverted siphons under construction.

### Covered Conduit

About 18 miles from the town of Mojave where the desert assumes a higher elevation, the conduit emerges from the mountains on to the level waste. Here for nearly 70 miles, steam shovels have scooped out an 8 x 12-foot ditch that has been lined and covered with concrete, as shown in one photograph, and which after following the low lying base of the Sierra westward along the Antelope Valley, finds a suitable grade and at Neenach



HYDRAULIC DREDGE *at work in excavation of canal in Owens Valley.*

crosses in the form of a concrete and steel siphon having a diameter of 10 feet and an aggregate length of 21,766 feet. Continuing for 9 miles along the northern base of the Sierra Madre, or, as it is commonly called, the Coast Range, the conduit empties into the Fairmont Reservoir. This basin is designed to regulate the flow thru the Elizabeth tunnel, which, with a length of 5 miles, carries the water to the head of San Francisquito canon on the south side of the range.

Two photographs show the driving of the tunnel and its completed concrete lining. Thru this region of bold and rugged topography the construction is similar to that described in the Sierra excepting that the dimensions are larger to provide for the maximum amount of power development.

### Tunnel

The elevation of the south portal of the Elizabeth tunnel is 2,934 feet above sea level; the outlet of the aqueduct 25 miles to the south is at an elevation of 1,485 feet, which provides a fall of more than 1,450 feet for the generation of electrical energy. Here will be built the most powerful of the generating stations, but below the Haiwee Reservoir and between the Upper and Lower San Fernando Reservoirs additional power aggregating 11,500 kilowatts can be developed.

If we now classify the various forms of construction and give more than passing glance to the first two noted, that of tunnels, we are sure to gain a more concrete understanding of the magnitude of the enterprise:

| *Classification* | *Length* |
|---|---|
| Tunnel | 42.69 miles |
| Power Tunnel | 9.23 miles |
| Open Unlined Canal | 21.14 miles |
| Open Lined Conduit | 39.56 miles |
| Concrete Covered Conduit | 97.72 miles |
| Haiwee By-Pass | 1.95 miles |
| Siphon (Steel and Concrete) | 12.06 miles |
| Flumes | .17 miles |
| Power Penstock | .44 miles |
| Other Power Construction | .30 miles |
| Reservoirs | 8.50 miles |
| Total Length of Aqueduct | 233.76 miles |

### Rapid Construction

Construction, despite all delays, as will be seen from the foregoing, has been carried on at a rate slightly in excess of 50 miles per year. With the exception of one small contract comprising easy classification and less than three per cent. of the work in point of distance, the entire construction has been done by day labor under the city engineers. At this time this longest and in many respects most wonderful water works system in the world is practically ready for operation, altho some finishing touches remain to be made.

From the outset, no expense has been spared to provide the most modern and effective machinery that hand and mind have been able to devise. Dredges, power steam shovels, machinery of varying design and purpose, trainload after trainload of dynamite, all these present-day aids to the construction engineers with their 4,000 men, have resolved the great task into what has been largely an example of perseverance. The unusual speed with which the work has been advanced is due in no small part to the ardor and loyalty of the division engineers and department heads, the friendly rivalry that has been manifested from the start and the esprit de corps of the whole organization.

COMPLETED SECTION OF AQUEDUCT, *two hundred feet above Owens Lake in the background.*

### Regulating Reservoirs

The cost of constructing the two San Fernando reservoirs for impounding the waters just below the aqueduct outlet will be defrayed from the revenues of the Water Department. These reservoirs, from 800 to 1,000 feet in elevation above the city, are designed to impound the flow of the aqueduct and to regulate the distribution of water as determined by the seasonal needs of Los Angeles and its environs. By this means such part of the daily normal flow of 258,000,000 gallons as is not needed during the rainy season will be stored and a daily supply in excess of 300,000,000 gallons daily will be made available during the seven months of the dry season when domestic and irrigation requirements are at their maximum.

In very brief form the foregoing de-

scribes the general plan and construction of the aqueduct system. The first of the new year, as was confidently promised in 1905, saw the enterprise practically in its finished form and it will be ready for operation in time for the formal celebration of its dedication to the use of the people of Los Angeles and vicinity, which is now

THE PATH THE STEAM SHOVEL TOOK. *Open conduit being prepared for concrete work.*

planned for May 13, 14 and 15, on a scale of national importance fitting its magnitude.

### Distributing the Surplus

The task of building the distributing system beyond the limits of the city is one yet to be undertaken and will require three or four years for its final accomplishment. It involves the expenditure of from $4,000,000 to $6,000,000 and the problem not merely of the application of the water to lands desiring it, but the placing of the water on that area which, now suburban, will be gradually included within the city so that the precious fluid shall be gradually diverted from irrigation to the use for which the aqueduct has been designed. At first, the city will take, in addition to the water now being drawn from the Los Angeles river, only one-tenth of the aqueduct supply or approximately 16,000,000 gallons daily. This quantity will be increased gradually as the city continues to expand until that day in the far distant future when the total flow from the long conduit will be required by the city and irrigation from this source will have ceased to exist. In other words the valuable use to which the larger part of the aqueduct supply is to be devoted at first, is simply the economic utilization of the surplus until such time as it is required in the city's mains. Los Angeles of the present has built for the Los Angeles of the future.

### Power Development

As has been stated, the construction of the aqueduct arose out of the necessity for a larger water supply and this is of course its primary purpose. The possibilities that lie in the generation of hydro-electric energy, however, from the standpoint of financial gain, make the project, as a water system, of almost secondary importance. By the building of power houses at advantageous points along the aqueduct, a total of 120,000 horse power can be developed.

In 1910 the city voted a bond issue of $3,500,000 for power development and the construction of the first power plant is now underway. This plant is 40 miles from the city and is designed to develop 37,500 horse power. With its transmission lines ending at a sub-station situated at the city limits, this plant will be ready for operation by next July. Other units will be built as fast as there is need for their output. Thus a great dynamic force is made available to be owned and operated by the municipality for the illumination of her streets, the lighting and heating of the homes of her populace, and for the extension of her rapidly growing manufacturing industries.

OWENS RIVER, *at the point where it is diverted to the Los Angeles aqueduct, eleven miles north of Independence, Inyo County, California.*

# FAILURE AND SUCCESS IN MUNICIPAL OWNERSHIP

IT is common for superficial observers and readers of official reports to make erroneous statements regarding the condition of the affairs of public service utilities, whether under municipal or private ownership. Not often regarding the latter, however, because few of that class are required by their charters to make such reports or are called upon to make them if provision is made for them or they can for any reason be requested so to do. According to Glenn Marston all plants failing to make such reports should be classed as failures, because, as he says, "in such cases it is a justifiable conclusion to believe that the plant is not sufficiently successful to make a report desirable." However, he applies his criterion only to municipally owned plants, altho he gives no reason, good or bad, for this favoritism, perhaps because practically all private plants are failures according to this definition.

### Reports Sometimes Misleading

Financial reports of public service utilities, whether the ordinary annual reports of city officials or employes in charge of them or the statements made for the purpose of promoting the sale of new issues of stocks and bonds on the security of the plants, however owned, are not generally noted for their completeness or accuracy. In the case of the municipally owned plant this is due to lack of knowledge of the principles of bookkeeping or to the character of state or municipal legislation, which divides the business and distributes it among unrelated officers who have little or no official communication with each other. In the case of the privately owned plant this may be due to too great knowledge of the possibilities of bookkeeping and the desire to make as good a case as possible and make the sale of the new securities as easy as possible.

In neither case are the reports evidence of failure or success of the plant. This evidence must be gathered by adding to the information contained in the reports such reliable information as can be gathered from other sources or from a careful study of the plant itself and the results of its operation.

It is easy for one biased in favor of municipal ownership or in favor of private ownership to select such figures or such cases as will bolster up his position, and still present a semblance, at least, of fairness and honesty on the basis of what are presumably the facts, since they are to be found in the published reports. It is seldom an advocate of one or the other system of ownership is so bent upon making a case as to mis-state facts, to garble statements and invent what he cannot find, as the above mentioned Glenn Marston is in a recent pamphlet, entitled "Two Hundred Municipal Ownership Failures," on which his name appears as author. Many of the statements made in the pamphlet have appeared in a monthly devoted to the interests of private ownership of public service utilities whose publisher is the same, so that the claim of authorship seems to be based upon quite as slight grounds as many of the other statements in the publication.

### Municipal or Private Ownership

MUNICIPAL ENGINEERING is not a partisan of either municipal or private ownership of public service utilities. Indeed it is disposed to favor such safeguarded semi-private, non-municipal ownership of such plants as the very successful Consumers' Gas Trust Company, which formerly supplied natural gas to Indianapolis, and its equally successful successor in the artificial gas field, the Citizens' Gas Company, which is supplying a high quality of gas at 60 cents to 40 cents a thousand cubic feet and paying the citizens who subscribed the capital to start it 7 per cent. dividends with business

only half developed. Next to this, and only after because of the danger of occasional political manipulation, is the expert control of both public and privately owned plants by state public service commissions, under which the nature of the ownership is comparatively unimportant. This magazine does, however, like to see fair play and cannot let such a publication as the one mentioned pass unchallenged, even if its reputed author does not carry authority and its publisher is a prominent and evidently biased advocate of the side so unfairly presented in it.

### Erroneous Reports on Municipal Plants

Information is at hand concerning nearly half the 192 plants included in the list, and indicates a possibility that 20 per cent. of the plants are properly classed as municipal ownership failures, an indication of very low efficiency in the editorial department of the publications under consideration. These failures are in small towns and some of them show equal or greater failures to supply good service and pay good returns under private ownership than they did under municipal ownership. What may happen in improvement of service by a change from private to municipal ownership is shown by the description of the Camden, N. Y., electric light plant, elsewhere in this number of MUNICIPAL ENGINEERING.

There would be too much repetition in showing all the errors of statement in the Marston list, so a few have been selected to show the various types of misrepresentation used and the field covered. Some of the more important cases will be treated in detail in special articles which will appear from time to time.

### Alabama

The true story of the North Birmingham water works, on the authority of Maury Nicholson, of the city engineer's department, is as follows: The town of North Birmingham, during its existence as a separate corporation, bonded itself for the construction of a water and light plant. They constructed and put in operation a small pumping station and light plant, which took water from wells in the vicinity of a large, deep limestone quarry and very near to the edge of Village creek. The city of Birmingham took in the corporation of North Birmingham in January, 1910, and inherited this water and light plant by this enlargement of territory. During the spring of 1911, an epidemic of typhoid fever broke out in North Birmingham and the health authorities traced the source of the trouble to this water supply. Upon their report of this fact, the city shut down the pumping plant and connected the North Birmingham pipe system with the pipes of the Birmingham Water Works, buying water from this company by meter measurements and selling to the consumer by flat-rate measurements. This condition of affairs has existed up to the present time. It is now intended shortly to disconnect from the Birmingham Water Works plant and reconnect with the former supply, precaution having been taken to remove the contamination, which is supposed to have come from the quarry or creek, both of which are connected by underground sources with the wells.

Clearly there is no evidence here, nor in the Marston statement, which is quite similar but more brief, that there has been a failure in municipal ownership. On the contrary, the city of Birmingham has evidently pursued the proper course, one which any company would have pursued and is continuing in the same excellent way. There may have been an engineering error in the original location of the wells, or they may have become contaminated by pollution developed later, but these difficulties are not peculiar to municipal ownership; indeed, cities are often better able to cope with them than private companies. The Birmingham Water Works has been obliged to purify its water supplies and to find new sources, and might be cited as evidence of failure of private ownership with equal unfairness and equal lack of good common sense.

### California

Ukiah, Cal., is an analogous case. The city electrician, William Bromley, says that in 1908 the old steam plant for generating electricity was closed and cur-

rent was purchased from a hydro-electric transmission line, because the city had outgrown the plant, fuel prices had advanced, and power from the hydro-electric plant could be purchased cheaper than it could be generated by steam. The old machinery was kept in reserve for two years and then sold. Light and power are sold cheaply and extensions, improvements and street lighting are all made and furnished without help from taxes or bonds. Marston's report is similar but is garbled and incomplete. The evidence of eminent success of municipal ownership is overwhelming in this case. There are numerous instances of the same sort in the list, especially in the western states where fuel is high and the new hydro-electric plants can furnish cheap current. Failure to take advantage of such opportunities would be evidence of the stupidity of municipal officials rather than of their competence.

### Georgia

In Edgewood, Ga., not only is the electric light plant defunct, but so is the town, it having been absorbed by the city of Atlanta and being now supplied with electric light, etc., by that city, and under no necessity of having a separate plant, as stated by Mayor J. G. Woodward, of Atlanta. No hint of the reason for abandoning the plant is given by Marston. This item is again typical of a number of those in the list.

### Illinois

Marston reports Moline, Ill., as able to save over $35 per lamp per year by selling a $25,000 plant for $7,900 and making a contract for street lights. Mayor Martin R. Carlson, on the contrary, says that the city of Moline never owned its electric light plant. It has always contracted for street lighting and is now paying $60 a year each for 340 1,000-c.p. arc lights. Possibly Mr. Marston has made a mistake this time and is trying to state the case of East Moline. But he is not much better off under this supposition, for that city, like Ukiah, Cal., is now purchasing electric current from the new hydro-electric power plant and will probably make a considerable saving from the former cost of operating by steam power; another evidence of good judgment in city officials and success in municipal ownership. Arc lamps now cost East Moline $65 a year each and metallic incandescent lamps $21 each.

### Iowa

Iowa cities have more or less complaint to make of incompetence, lack of public spirit, or dishonesty in public officials and Marston comes nearer stating the facts in this state than in any other, except possibly Ohio. But even here he selects his facts to suit his theory. Thus he quotes the Dubuque reports on water plant for 1907. Mayor M. O. Lyons states that the report was undoubtedly true up to 1907, at which time the old board of water works trustees was superseded and the superintendent found guilty of mismanagement and embezzlement. No enterprise, either municipal or private, could possibly have been other than a failure with the methods then employed. Since that time a new water commission has introduced more business-like methods and the plant is now able to pay out of the earnings from its private business a contribution to the extinguishment of the bonded indebtedness of the plant and to take care of the depreciation. The major part of the bonds and interest are paid from the proceeds of a special tax which are equal in amount to the value of the fire protection service rendered to the city by the plant.

### Kansas

The Ottawa, Kan., municipal light plant is included in Marston's list of municipal ownership failures because "the operating and maintenance expenses of the water and light business have not been separated." Such judgment as this is sufficient to condemn the author's judgment on any proposition that he may make, especially since the combined water and light plant pays all possible charges against it, including operation and maintenance, interest on bonds, new construction and equipment equivalent to an ample depreciation charge, $2,000 of maturing bonds, and $3,000 of bonds purchased for the reserve fund.

### Kentucky

Marston's statement regarding Henderson, Ky., is that "in April, 1912, the city abandoned its expensive generating station and made a contract for electric power with the Henderson Traction Company at a much lower rate than the cost of operating its own plant." Mayor W. J. Thompson reports that this statement is "twisted so that south is changed to north. The facts are that in April, 1912, the traction company and an interurban line running from here to Evansville abandoned their power station, and contracted with the city to furnish power for them, on which contract we are making a handsome profit. I wrote to Mr. Glenn Marston in regard to his incorrect report and he agreed to correct this false statement and said that the publisher of *Public Service* would make the same correction. If you see the correction could you send it to me?"

### Louisiana

Mail sent to Brighton, La., whose gas plant is reported by Marston to be a failure, is returned stamped "No such postoffice in state named."

### Massachusetts

The manager of the North Attleboro, Mass., electric light station is reported by Marston to have recommended that the city abandon its generating station and purchase power from a nearby private company, as it is very costly to run the antiquated station of the city. The manager, William Plattner, strongly resents this erroneous statement, showing by a list of equipment that all of his electric equipment and nearly half his engine equipment was installed in 1907 and is modern in every respect. He further says: "The reason I recommended the purchase of current was on account of the anticipated increase in the power business. Our present business has taxed our station to the full capacity, and we secured a very attractive low rate which we considered greater economy than to install additional equipment. We are purchasing a portion of our current at a price lower than any other municipality in Massachusetts, considering the business we do. We operate our plant during the peak load, which is about five hours, and the balance is purchased. This is a business proposition that any private corporation would have done if similarly situated. I can name you several large private corporations of electric light and power that have practically shut down their plants or a portion of same within the last few years and purchase their current from other sources, not because a plant is antiquated but conditions of manufacture are such that a large transmission or private corporation doing extensive business was in a position to take on a smaller proposition at a more attractive price than they were able to manufacture it themselves." He cites such large companies as The Edison Electric Illuminating Company, of Boston, as serving surrounding suburbs cheaper than local plants could do it. Apparently Mr. Plattner's plant is managed efficiently and Marston is again guilty of misrepresentation, of favoritism and of bad judgment, either in classing the plant as a failure or in failure to class the private plants taking the same steps as failures likewise, for if one is a failure they are all failures by the same token and cannot be separated into municipal and private ownership classes of failure. This sort of failure is quite similar to those of the West where small plants save money by buying current of large hydro-electric plants.

### Michigan

Marston's statement that the municipal electric plant of Elk Rapids, Mich., did not pay and was sold in 1908 to the Elk Electric Company, is denied by A. G. Maxwell, village clerk, who says that the town never owned a light plant. The successive owners of the plant from which the town purchases street lighting have been W. E. Donnelly, Elk Rapids Electric Co., and Elk Electric Company, demonstrating wilful misstatement or equally inexcusable carelessness in ascertaining the facts.

### Minnesota

The statements about the gas plant at Duluth, Minn., are on a par with those regarding purchases of electric current

from outside sources, it being cheaper to purchase the gas which is a by-product of the coke ovens of the Zenith Furnace Company than to manufacture gas by the usual processes, so that this is an example of good management rather than of failure.

### Mississippi

The city attorney of Pontotoc, Miss., reports that "municipal ownership was a failure, due to poor management. However private ownership was a failure, due to the same cause, up to September, 1912, when the plant got into present hands."

### Missouri

Marceline, Mo., is another victim of Marston's misrepresentations, whether thru carelessness or design, for he says the "town had one of the first municipal electric plants but it did not pay. The city operated it until it burned. Sentiment was so strong against municipal ownership that the plant was not rebuilt," whereas Mayor E. S. Haldeman says: "Our plant did not burn. We are still operating our plant and meeting our regular payments on plant and meet our monthly bills promptly and get our discounts. We have paid off part of our bonded debt sixteen years in advance and have never missed an interest date and have money on hands now."

### New York

Returns from three of the six New York plants in Marston's list have been received and show equally flagrant misrepresentations, the following from F. D. DuBois, superintendent of the Mohawk municipal commission, being a fair sample: "The statement concerning the Mohawk municipal light plant is false in every particular. It has not been sold or leased to a private company, and further, out of $6,300 receipts at rates of from 6 to 10 cents per k.w., the reports show a net income for year of $1,879.44."

### North Carolina

High Point, N. C., is another "failure" similar to those in California, being able to purchase street lighting and current for distribution to commercial customers at less cost from a hydro-electric company than the city could make it, low enough, in fact, to be able to charge half the retail rates of private corporations in surrounding towns.

### Ohio

Marston's report regarding Willoughby, O., is partially correct, but instead of a franchise being granted to a traction company for furnishing electric light, Mayor Sidney J. Wilson reports that they "no longer generate the electricity, but buy it wholesale from electric railroad line and retail it over our own system of wires."

### Pennsylvania

The secretary of the borough of Grove City, Pa., L. L. McKay, states that there was a deficit in the financial condition of the electric light plant in 1909, but the plant was "put in in 1908 and would hardly be a paying investment immediately, but our auditor's report of January, 1912, gave it $1,300 over all expenses, and that of January, 1913, $1,720.90 cash gain," so that Marston was hardly fair in suppressing all the facts but the one of a deficit in one year's operations.

### Tennessee

Lebanon, Tenn., is another instance of good judgment in purchasing current wholesale and selling it retail of which so many have already been mentioned.

### Texas

El Paso, Tex., is reported by Marston to have put into effect a rate of 20 cents a thousand gallons when it purchased the water works and to have been obliged to increase to 30 cents. Whether this be true or not, Mayor C. E. Kelly reports that a reduction of 50 per cent. in rates went into effect March 1. Mr. Marston seems in this case, as in that of Grove City, Pa., to have been a little too prompt in his condemnation of municipal management, for, given time to get into full operation, both cities have turned losses into gains.

### Washington

Ballard, Wash., is another example of a small city absorbed by a larger city, Seattle, and now served by that city. Both

Seattle and Tacoma are most inexcusably misrepresented in Marston's list, but their plants are important and interesting enough to require treatment in special articles now under preparation.

### Wisconsin

Failure to furnish fire pressure at a test for 42 minutes after signal was given is given as the reason for including the Madison, Wis., water works in Marston's list of water works failures. Unfortunately this sort of failure is not restricted to municipal plants, and Madison was no worse off than many cities under private ownership, so that the one may be offset by the others. Actually the occurrence did demonstrate a lack of cooperation of water works employes or a lack of discipline, which might be considered a little more likely to occur in a municipal than a private plant, but Mr. Marston seems to miss this point and lays the failure to lack of water rather than to the neglect to repair an important valve.

The foregoing examples have been limited to one in each state from which reports have been received. Others will be given from time to time as opportunity offers.

## License Fees Charged by City of Buffalo

Some of the license fees charged by the city of Buffalo are as follows: Annual fees—Auctioneers, $50.00; bakers and confectioners, $3.00 to $10.00; billiards and pool, $5.00 per table; bowling alleys, $5.00 each; butchers, $15.00; employment agencies, $25.00; fish markets, $10.00; junk dealers, hand wagon, $2.00; one-horse wagon, $3.00; wholesale, $25.00; milk, per wagon, $2.00; wholesale oil, gasoline, paint and dealers in other inflammable and volatile liquids, $20.00; retails dealers storing inflammable oils, $1.00; peddlers, $25.00 to $100.00; pawnbrokers, $50.00; dancing schools, $25.00; second-hand dealers, $10.00; vehicles, one-horse, $1.00; two-horse, $5.00; slaughter houses, $25.00. Theaters, moving picture shows and amusement parks are taxed $100.00 per annum; circuses, $75.00 to $200.00 per day. During 1911, 18,111 licenses were issued, including dog licenses, at $1.00 and $2.00, and horse licenses at $1.00 per horse.

# ROAD CONSTRUCTION IN MICHIGAN

*By Frank F. Rogers, C. E., Deputy Highway Commissioner.*

On Michigan state reward roads the law requires that the steepest incline shall not exceed six per cent. On macadam roads it should be 3 per cent or less where cost is not burdensome. Long stretches of unbroken grade are objectionable, however, being more expensive to maintain than roads that are slightly undulating. It is estimated that horses can exert one-tenth of their weight as a tractive force on continuous work, but they can readily exert themselves for brief periods of time up to three, or even four times their daily average, so that short stretches of undulating grades, none of which exceed six per cent. can not materially lessen the capacity of a macadam road.

### Cost of Grading

Where old roads have been regraded to make state reward roads, the cost has usually run from $200 to $500 a mile, $350 being a fair average. Some hilly roads have been graded at costs greater than $2,000 a mile. No tool is so efficient as the road grader in skillful hands, although the plow and harrow are frequently required to put the road in shape for using the grader to advantage. On turnpikes with deep ditches, the flat, or Doan scraper, is an excellent tool. The drag scraper is good for hauls up to 150 feet. Between that distance and 700 feet, wheel scrapers are best. For hauls longer than 700 feet it is cheaper to use wagons.

### Drainage

In most soils sufficient drainage is provided by side ditches just large enough to provide for the free flow of such water as naturally comes to the road. In clay soils the bottoms of the ditches should not be less than two feet below the crown of the road, unless supplemented by tile drains. Especial pains must be taken to provide all road ditches with free outlets having sufficient fall to remove all water to some distance from the road. Tile drains are needed in all springy or water bearing soils. It is usually advisable to cover the tiles six inches or more with gravel, cinders, or broken stone.

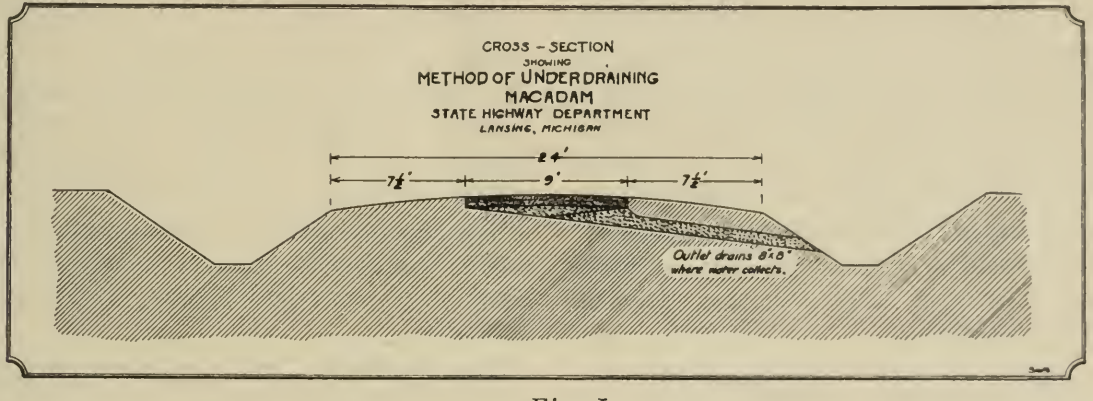



*Fig. I.*

In clay soils trenches should be cut thru the shoulders described in the next paragraph, thus making outlets into the side ditches for water that may collect in the stone bed during construction, and afterwards until the surface becomes hard and water-proof. Such trenches should be 8 inches or 10 inches in width and slightly deeper than the stone bed. (See Fig. I.) These drains should be placed on both sides, in pairs, at every low point in the grade and, in very retentive soils, at intervals of not more than 100 feet.

FIG. II. BROKEN STONE *filled in between shoulders, with roller at work.*

On grades above 4 per cent trouble is caused by the washing out of the side gutters. This can be effectively prevented by paving the gutters with cobblestones or concrete or by spreading evenly over the bottoms of the gutters a three or four-inch layer of crushed stone, preferably that under 1½ inches in size. Coarse gravel has been used for this purpose with good results.

### Macadam Bed and Shoulders

The macadam bed should be formed by placing shoulders of firm earth, or other suitable material, on each side of the center line and far enough apart to retain the proposed width of macadam, which, on Michigan state reward roads, must be at least 9 feet wide and not less than 6 inches deep after compacting. Any greater width and depth that the builders desire to make would be approved by the state but would not, under present laws, entitle the road to any greater bounty.

The shoulders are formed by scraping earth from the center to each side with a road grader, or if the old grade is low, by bringing up earth from the sides with the grader, provided it can be spared from the gutters or ditches. A common mistake is to excavate unnecessarily large ditches along the roadside at the foot of a fill, for the purpose of forming the embankment, which should never be tolerated in highway work. On sandy or mucky ground, any of the clayey or loamy soils are suitable for shoulders, but a good packing gravel is better. A double layer of sods about one foot in width, placed grass side down and backed up with sand or other light soil, makes a very satisfactory shoulder.

The shoulders thus formed should extend to the side ditches or gutters with the same grade and curvature as required for the finished road, viz: an average rise of one inch for each foot of distance from the inner edge of the ditches or gutters to the center line of the road. Thus, a twenty foot roadway would have a 10-inch crown and a 24-foot roadway a 12-inch crown. With this kind of road section, the drop at a point 5 feet out from the center line should not exceed 3 inches.

Hand trimming with mattocks and shovels will bring the macadam bed to the exact sub-grade, giving it the same width and curvature as required for the finished road. Due allowance must be made for settlement of the sub-grade by rolling. Crushed stone is far too expensive a material to fill hollows with, for they can be filled with earth from the shoulders at less than one-tenth the cost of broken

stone, and every high point protruding into the macadam means a defective place in the finished road and hastens the day when repairs will be necessary.

### Suitable Stone for Macadam

In Michigan the most used road stones, in the order of their values are: trap, cobblestones or field boulders, and limestone. The former is found only in the Upper Peninsula, and, thus far, has not been used on country roads except in the counties of Dickinson, Gogebic, Houghton, Keweenaw and Marquette, altho some has been shipped to Detroit for park roads. A large part of the limestone macadam used on the west side of the state is shipped across Lake Michigan from Wisconsin.

Cobblestones consist of a variety of rocks from the toughest trap thru the various granites and limestones to sandstones of no value to the roadbuilder. They are usually crushed with portable machines placed near where they are to be used.

### Crushing Cobbles

There is no difficulty in crushing cobblestones with portable crushers, where the best types of steel crushers are employed. Traction engines rated at from 15 to 20 h. p. will easily drive any of these crushers. It is not economy to use a steam roller for this purpose. It is needed for rolling every day the crusher is running, and is too expensive a machine to wear out for power purposes.

Purchase cobblestones by weight. From 13,500 pounds to 14,000 pounds are required for a cord, which will make 5 cubic yards of crushed rock measured in the different grades.

The cost of crushing cobblestone, including labor, fuel, oil and small repairs, can be kept down to 30 cents per cubic yard. Repairs, depreciation, interest, etc., would add another 20 cents.

The rotary screen has a drum not less than 9 feet long and 30 inches in diameter, perforated to give three required sizes of metal. When crushing cobbles, the writer prefers ¾-inch, 2-inch and 3-inch holes. If the stone is so soft that too large a percentage of screenings passes thru the ¾-inch holes, a ½-inch mesh wire screen should be placed around the plate screen and bolted to it, forming a jacket. If too much dust is produced, as might be the case with limestone, a ¼-inch mesh wire screen attached as above described, may be used as a dust jacket and the dust spouted into a special pocket.

The three grades of stone are discharged into separate pockets of the storage bins from which they are drawn by gravity directly into the wagons in the order they are to be placed on the road. The fine stone is commonly called "screenings" or "binder," but the grades are usually designated by the numbers 1, 2 and 3—number 3 being the largest size.

Limestone, which is used for building most of the macadam roads in Michigan, is usually bought from the large commercial crushing plants, broken to sizes and delivered within teaming distance of the road.

### First Course of Macadam

On the prepared bed the first course of No. 3 stone is laid to make the depth not less than 3½ inches after rolling, say 4½ inches loose measure. If a harder and more expensive stone is to be used for the surface, the bottom layer may be increased to 5 inches loose measure and the top layer thinned accordingly.

The different sizes of stone must be well mixed. Alternate patches of large and small-sized stones will not make a road surface that wears evenly. Unless automatic spreading wagons are used, it is best to make three or four dumps of each load, so that the least possible amount of handling with rakes and shovels will be required. In no case should this layer be put on a muddy bed. After the stone has been spread it should be rolled two or three times with a power roller weighing about 10 tons and then covered with No. 1 stone (screenings) to a uniform depth of about ¾-inch and rerolled. The rolling should commence on the edge of the stone with about half of the outer rear wheel of the roller lapping on the earth shoulder, and gradually lapping towards the center as the rolling continues. As soon as one-half of the roadway is thus rolled the roller should be run off the stone and started on the other side, finishing at the center. Any other method will soon destroy the crown of the road. (See Fig. II.)

The amount of screenings used should be somewhat less than enough to fill the voids in the No. 3 stone. Water may be applied in advance of the roller when working on sandy soils but not until the roller has passed a few times over the dry screenings. But water should be used sparingly, if at all, on the No. 3 stone when building over clay and loamy soils on account of the tendency to form mud on the sub-grade, into which the stone is driven by the roller. The rolling of this course must continue until the binder is all worked into the crevices of the larger stones and until the stones cease to sink or creep beneath the roller. If hollows develop by reason of this rolling, they should be filled with suitable stones of the same grade and not with screenings.

If commercial limestone is used, it is better to use stone that will range from 1½ to 3 inches in greatest dimension, and to use the same grade of stone for both the bottom and top layers, but it is very important that the stone shall be evenly mixed when spread upon the road. When limestone screenings are used for binder, only those from which the dust has been removed should be accepted. Plenty of dust for cementing purposes will be formed under the roller, and, when the road is once consolidated, the less dust on the surface the better. This dust is a nuisance in dry weather and makes a disagreeable mud when the weather is wet.

Before placing the first layer of stone on dry mealy sand sub-grades, it is often necessary to spread a thin layer of marsh hay, rotten straw or some other vegetable fibre to prevent a large part of the No. 3 stone being driven into the sand so deeply that it is of little value except as a sub-base. An extra layer of stone rolled into the sub-grade makes a foundation equally as good or better than the materials above mentioned, but the cost of the stone usually makes this latter method so expensive that it is prohibitive.

### Top Course of Macadam

After the first course of macadam has been applied and bonded and rolled as above described another layer of stone must be added and of such uniform thickness as to make the total compacted depth of the road at least 6 inches, if it is expected to draw state reward. The stone used in this layer will be that known as No. 2, which passed thru the 2-inch perforations of the crusher screen and was caught in the second pocket of the elevator bins. However, should limestone from

FIG. III. PORTABLE STONE CRUSHER, *screen and bins. Cobble stone pile on right, wagon loading crushed stone on left.*

the commercial quarries be used, it is better to purchase stones ranging from 1½ to 3 inches in size, as already specified for the first course of macadam. Stones of this size wear much better, are not easily dislodged and left in a loose condition on the road bed, nor so easily picked up by the mud that adheres to the wheels of vehicles. Some engineers have placed the No. 2 limestone in the bottom layer and the No. 3 limestone in the top layer, and the results are reported to be very satisfactory.

When the stone for the top layer has been spread as above described, it shall be rolled until smooth with a 10-ton power roller, after which screenings (No. 1 stone) will again be applied to the uniform depth of about ¾ of an inch and rolled a few times over before wetting. From this on, water must be applied freely from a horse sprinkler and the rolling continued until the water flushes to the surface. As the rolling progresses, the screenings will have to be added until all the voids are filled and a very thin coating of screenings covers the surface.

In no case should the screenings be dumped in piles on the loose stones. When this is done, the screenings are never evenly spread and many of them are wasted. Too many screenings are detrimental to the road as well as a total waste of the most expensive part of the road covering, particularly if made from hard stone. Unless the screenings can be spread evenly with automatic spreading wagons, it is best to place them on the shoulders along the sides of the roadway and then spread them carefully by hand. Pains must be taken to apply the screenings evenly mixed. Casting crosswise of the road with shovels invariably places the chips on the far side and the dust on the side where the spreader stands. This can be overcome by casting lengthwise of the road with a swinging motion of the shovel.

In the final rolling the whole surface of the roadway, including the shoulders, must be covered. Hollows that may have developed in the shoulders must be filled, and high places leveled down and the process of leveling and rolling continued until the whole road grade from gutter to gutter is so firm and smooth that water will flow to the side drains without obstruction. Fig. IV shows both layers of stone and a steam roller at work.

After rolling the road should be kept closed to traffic until the surplus water has dried out, taken a "set," and become so hard that it will have a metallic ring when driving over it and small pieces of rock will crush under a heavy load before penetrating the surface.

The amount of rolling and water required are much more than the inexperienced road builder will expect. About 900 barrels of water will be required for each mile of 9-foot macadam roadway, which is no small item of cost if the water is not very handy. If the water is not used to the best advantage more will be required.

A steam roller cannot compact more than 50 to 75 cubic yards of crushed rock daily. That is about the output of the ordinary portable rock crusher and means that from 20 to 30 days of steady rolling are required to consolidate properly a mile of state reward macadam road.

### Cost of Macadam Roads

The average cost of macadam roads in Michigan is running slightly less than $4,500 a mile. Some roads have been built for less than $3,000, while others have cost more than $8,000 per mile. The higher costs usually mean that the grading cost was high, or that the width of macadam was made greater than 9 feet.

As the grading cost, the material cost and the distance the material has to be hauled are the three items subject to greatest variation, a model estimate will be given on which the above items will be taken at fair assumed values, so that they can be changed by anyone desiring to make other estimates that will fit different conditions and places where these values have been determined.

First, we shall assume that crushed limestone is to be purchased from a commercial quarry and delivered f. o. b. cars at some siding within a wagon haul of the proposed road. The estimates are as follows:

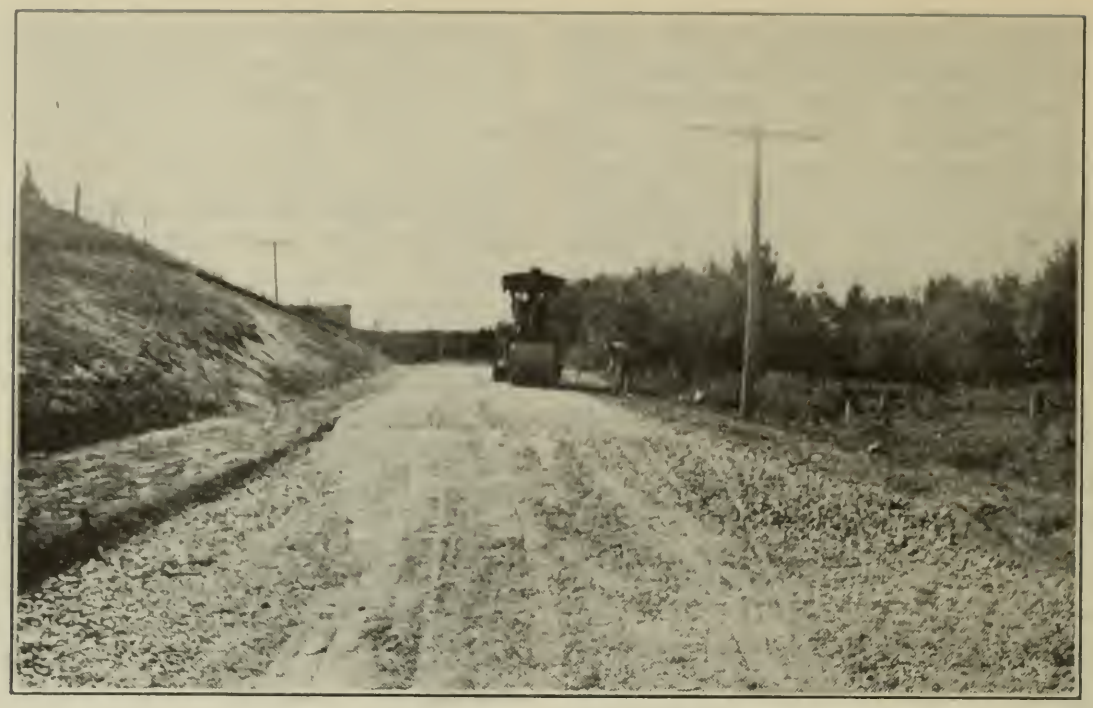


FIG. IV. PLACING BROKEN STONE. *Foreground has received first broken stone. Farther back second layer is placed, and roller is at work on it.*

| | |
|---|---|
| Grading, per mile | $ 350.00 |
| 1,200 cu. yds. crushed stone, 1½ to 2 in. in size, at $1.40 | 1,680.00 |
| 300 cu. yds. screenings with dust out, at $1.40 | 420.00 |
| Loading and hauling 1,500 cu. yds. stone one mile, at $ .45 | 675.00 |
| Spreading same, $ .05 | 75.00 |
| Sprinkling and rolling, 25 days at $15.00 | 375.00 |
| Superintendence and contingencies | 200.00 |
| Total | $3,775.00 |

If crushed cobblestones are used, 300 cords to the mile will be required. These should crush into 1,500 cubic yards, measured in the different grades. The crusher should be set but once for each mile of road and as near the center of the mile as is practicable. In this case, the stone cost at $4.00 per cord would be as follows:

| | |
|---|---|
| 300 cords cobbles at $4.00 | $1,200.00 |
| Crushing 1,500 cu. yds. at 50c | 750.00 |
| Hauling 1,500 cu. yds. of stone to to the road (no shoveling into wagons required) at 30c | 450.00 |
| Total | $2,400.00 |

This shows a saving on stone delivered to the road of $375.00 and we may assume that the other items will remain the same. In such a case, one would be justified in paying $5.25 per cord for cobbles delivered at the crusher, as compared with commercial stone at $1.40 per cubic yard on cars one mile from the road.

The following cost is taken from a Michigan state reward road built in Golden Township, Oceana County, by Fred Urtel, Township Highway Commissioner:

| | |
|---|---|
| Grading | $ 237.40 |
| 301½ cords cobbles at $4.00 | 1,206.00 |
| Crushing same | 547.87 |
| Hauling stone from the crusher and spreading on the road | 500.20 |
| Rolling and sprinkling | 208.12 |
| Superintendence and plans | 162.12 |
| Total | $2,861.71 |

The above cost is very low and does not include profits to any one, nor rental or depreciation for the machinery used. It is all owned by the township and the work was performed by day labor under the direction of the township commissioner. It does include, however, the cost of moving the crusher from a former location and erecting it on the job, as well as fuel and oil and other incidental expenses. It might be further said that the finished road was a credit to its builders.

Fig. III shows the crusher at work on the above road, with a portable bin on trucks. Note what is said above about using the roller for power purposes.

# MUNICIPAL LIGHTING PLANT OPERATED BY OIL ENGINE

*By L. F. Phelps, Clerk of Camden Light Commission*

THE municipal electric plant in Camden, N. Y., was constructed in 1905 and 1906 after several years of more or less unsatisfactory experience with private ownership of a lighting system which in itself was neither reliable nor efficient. The power house is of brick construction, attractive in appearance, and designed with the combined idea of convenience and utility. The engine room occupies the main and front portion of the building while in the rear are located the shop and office, both of which, however, extend to but one-half of the height of the building, thus leaving a balcony for storage purposes above them and facing the power house proper. There are two basements separated by fireproof walls; one used as a furnace cellar while in the other are located the two Ingersoll-Rand air compressors which form part of the Diesel motive equipment.

### Oil Engines

The original power installation consisted of one vertical type American Diesel oil engine of 170 h. p., direct connected to one 130 k. w. Westinghouse a. c. generator. The commercial lighting circuit is divided into two trunk lines, each supplying one-half of the town. The street lighting is accomplished by means of 74 a. c. Westinghouse enclosed series arcs, giving 2,000 c. p. and located at moderate distances, practically on every corner. It is a general opinion that there is no better lighted town in New York State, and few that are its equal. In 1911 the business had increased to such a degree that more power was imperative, and a proposition brought before the people for the required addition was almost unanimously adopted. Accordingly, a second Diesel engine of 225 h. p., made by the Busch-Sulzer Bros. Diesel Engine Co. of St. Louis, Mo., was installed and the electrical machinery, consisting of a 160-k. w., a. c. generator was furnished by the Fort Wayne Electric Works. The plant is now well situated to furnish all light required and give continuous service to all desiring it.

The Diesel oil engine will produce electricity at about one-half cent per k. w.-hour, including all operating expenses, but no fixed charges. One hundred and fifty horse power can be produced for one hour on seven or eight gallons of fuel oil.

### Rates

At present there are 270 consumers connected with the commercial branch, all on a meter basis. Current is charged for at the rate of 10 cents per k. w., with discount of 20 per cent. if paid before the tenth of the month following that for which the bill is rendered. The municipality furnishes meters with the understanding that in so doing no bill will be rendered for less than $1.00 a month. The option of buying a meter from the plant, at a reasonable figure, is given all customers, in which case the minimum charge becomes 50 cents per month, with regular terms as in the first case.

The street lights, of whose type and size mention has before been made, are charged to the city at the rate of $50.00 a lamp per year. This method is the same as might be conducted with an individual lighting corporation with the important exception that in the latter case the sum of $3,700 is paid annually for light exclusively, while in successful municipal ownership this amount is virtually retiring interest charges and bonded indebtedness and thus eventually providing for street lighting at no cost to the taxpayers, who are the actual owners of the lighting business.

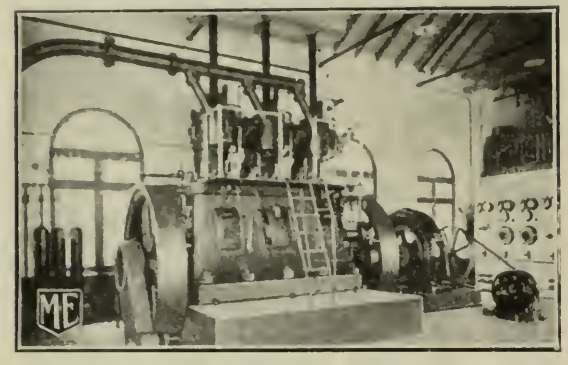
### Cost of Plant

The system was first constructed at a cost of $40,000, and during the past year

there has been added equipment to the amount of approximately $19,000, of which the following is a summary:

| | |
|---|---|
| Engine and auxiliaries, including purchase price paid to Busch-Sulzer Bros. Diesel Engine Co., freight, belts, etc. | $14,700.00 |
| Electrical apparatus, including generator, exciter, motor, switchboard panel, all from Fort Wayne Electric Co. | 3,200.00 |
| Concrete work, foundations, engine bed, etc. | 325.00 |
| Labor of installation | 600.00 |
| Miscellaneous expenses | 175.00 |
| Total | $19,000.00 |

Of this amount, $18,000 is covered by a bond issue against the village of Camden and the balance of $1,000 consisted of an appropriation from the sinking fund of the plant.



225 H. P. DIESEL OIL ENGINE *direct connected to Fort Wayne Electric Works* 160 *w. a. c. generator.*

### Operating Figures

The following figures taken from the annual report of the Camden Light Commission give an accurate idea of the operating side of the institution and show the system to be on a sound financial basis:

| | |
|---|---|
| *Revenues* | |
| Commercial lighting | $ 5,741.58 |
| Street lighting, unpaid from 1911 | 616.66 |
| Street lighting, 1912 | 2,466.67 |
| Wiring, etc. | 373.28 |
| Total | $ 9,198.19 |
| *Balance on hand March 1, 1911* | 3,280.93 |
| | $12,479.12 |

| | |
|---|---|
| *Disbursements* | |
| Salaries and wages | $ 2,431.94 |
| Fuel oil | 1,179.57 |
| Lubricants | 312.61 |
| Street lighting supplies | 135.93 |
| Misc. operating expenses | 164.56 |
| Repairs of all equipment | 233.08 |
| Office expenses | 85.73 |
| Total maintenance and operating expenditures | $ 4,543.42 |
| Added to equipment of plant | 434.36 |
| Bonds retired | 1,600.00 |
| Interest charges | 1,380.00 |
| Credit to sinking fund | 2,500.00 |
| *Balance on hand March 1, 1912* | 2,021.34 |
| | $12,479.12 |

| | |
|---|---|
| Balance on hand March 1, 1912 | $ 2,021.34 |
| Due for street lighting | 1,223.00 |
| Other outstanding accounts | 162.15 |
| | $ 3,406.49 |

### Cost of Oil

These figures are necessarily condensed and explanatory details are omitted. However, the essential details are given and can easily be understood. The cost of fuel oil which is used in the engines varies from year to year. It has been purchased as low as 2.9 cents per gallon delivered, but at the present writing the quotation is unusually high. It is indeed difficult for the average consumer to comprehend exactly why this should be, but the fact remains that the increase has been rapid for the past six months and the price is now nearly double what it was a year ago. Users of oil engines generally are anxiously awaiting a reduction in cost, but whether they and others will receive that for which they are wishing is doubtful.

### Favor Municipal Ownership

The plant at Camden is in first-class condition, both from mechanical and financial standpoints, and the little pessimism which was rife for a few years after its establishment has gradually disappeared under a sound business management by a commission of practical business men. Camden is more than strong for public ownership of its utilities and now owns and operates both lighting and water systems, each of which is a well-paying proposition and a strong plea for municipal control of the general necessities.

# WATER SYSTEM FOR UPPER WILLAMETTE VALLEY, OREGON.

*By Louis C. Kelsey, M. Am. Soc., C. E.,*
*Consulting Engineer to Oregon State Board of Health.*

*Louis C. Kelsey, M. Am. Soc., C. E., the author of the cooperative plan for supplying water and power to a string of cities and institutions has been a prominent municipal and hydraulic engineer in the Intermountain country and on the West Coast for some twenty-five years. Eighteen years of this time was spent in the department of public works at Salt Lake City, Utah, first as assistant city engineer and later as city engineer. Some years ago he removed to Portland, Oregon, and engaged in private practice, serving for some years also in his present position of consulting engineer to the State Board of Health of Oregon.*

*He constructed some millions of dollars worth of pavements for Salt Lake City and for Hillsboro, Oregon. He designed and supervised large extensions of outlet sewers and pumping plant for the same for Salt Lake, including a surface drainage system for the lower part of the city; sanitary sewers for Blackfoot, St. Anthony, and Burley, Idaho, and Linton, Ore.; sewers with disposal plants for Gooding and Hailey, Ida., Newport, Hillsboro, Newburg, and LaGrande, Ore., Sparks, Winnemucca and Las Vegas, Nev., Elma, Wash.; and storm sewers for three of these cities. His work for Idaho Falls, Ida. included hydro-electric power and lighting and water-works pumping plants, street and sidewalk construction and surface drainage.*

*The present session of the Oregon legislature is considering the passage of laws which will make it possible to carry out the plan outlined by Mr. Kelsey in this article.*

SINCE December, 1911, I have been making reconnoissances, investigations and preliminary surveys for determining the most desirable supply of wholesome water in sufficient quantity from a lake in the Cascade Mountains for the present and future needs of the cities and towns in the upper Willamette Valley, Oregon.

LOUIS C. KELSEY.

This project is of utmost importance to many municipalities in that section and my opinion is that Clear Lake, 76 miles east of Eugene, Ore., should be tapped and its water brought to the valley for the supplying of a dozen or more cities and state institutions, as far north as Salem, 75 miles from Eugene.

That an adequate supply of water of pure quality is essential to the welfare and growth of the municipalities in the upper Willamette Valley, is an accepted fact. Independent of the important consideration of promoting the public health, every community should have sufficient water supply under pressure for both present and future needs for fire protection, flushing sewers and paved streets, lawn and street sprinkling, and for all domestic and municipal purposes.

### Need for Pure Water

In the year 1906 and again in 1910 the people of Eugene were afflicted with an epidemic of typhoid fever, and in 1909 a similar and equally serious epidemic, also traceable to the water supply, was in Salem, but only temporary remedial measures have been adopted in these cities

looking toward more acceptable conditions of water supply. The City of Eugene has installed a mechanical filtration plant and is also using hypochlorite of lime to minimize the impurities of the river water. At Salem the water company uses the same chemical agency to purify the river water after it passes thru crude sand filters. The adoption of these means has lessened to an appreciable degree the hazard to public health thru using water, partly purified, for domestic purposes.

Incidentally, attention has been drawn at this time by the public press to the breaking out of an epidemic of typhoid fever at Oregon City. While the source of the epidemic has not yet been definitely traced, it is significant that Oregon City take its water supply from the Willamette River, nearly 40 miles below Salem, thru a mechanical filtration plant which has been praised for its efficiency.

### Purity and Volume of Clear Lake

Clear Lake empties into the McKenzie River, which in turn flows into the Willamette near the Irving, and is the main feeder of that stream. Careful analysis of its water for the health board shows less than 100 organisms to the cubic centimeter, and no colon bacilli, the harbinger of typhoid. Its water is therefore classed as "exceptionally pure."

Clear Lake's water is clear as crystal at all times and as cold as ice. No sediment has been known to appear in this water, even at the outlet, and because of the same conditions existing down as far as the proposed point of diversion it would be unnecessary to provide for settling basins or reservoirs other than distributing reservoirs at or near each city.

The length of the great pipe would be 150 miles, and it would vary in diameter from 44 to 35 inches. In a single day it would bring down from the mountain lake 30,000 gallons of the purest water, enough to supply a population of 200,000 persons and enough, it is further estimated, for all the needs of the upper Willamette valley for 25 years to come.

This is a water supply greater than was brought to Portland by its first Bull Run pipe line, constructed in 1893, which served the city until the laying of the second line two years ago. This first line brought only 24,000 gallons a day to the city.

If the whole available water supply of the lake were needed, it could furnish all the water that 1,500,000 persons would need.

### Municipalities and Institutions to Be Served

The twelve valley municipalities which the proposed pipe line would touch are Sprinfield, Eugene, Creswell, Junction City, Halsey, Coburg, Harrisburg, Albany, Brownsville, Jefferson, Independence, Turner and Salem. In addition to these the small towns of Irving, Tangent, Marion and Shedd are among those whose growth will soon require a public water supply.

The existing means of water supply are as follows:

| Municipalities and Institutions. | Source of Water Supply. | Method of Purification. | Means of Delivery. |
|---|---|---|---|
| Albany | Canal from Santiam River | Filtration | Pumping |
| Brownville | Callapooya River | None | Gravity |
| Coburg | Shallow well | None | Pumping |
| Eugene | Willamette River | Hc. of lime filtration | Pumping |
| Harrisburg | Well near Willamette River | None | Pumping |
| Independence | Wells near Willamette River | None | Pumping |
| Jefferson | Mill race from Santiam River | None | Pumping |
| Junction City | Well near Willamette River | None | Pumping |
| Salem | Gravel bar in Willamette River | Hc. of lime sand filtration | Pumping |
| Springfield | Mill race from Willamette River | Filtration | Pumping |
| Capitol | Salem Water Company's service | Filtered | Pumping |
| Insane Asylum | Drinking water from well | None | Pumping |
| | From Mill Creek for other uses | None | Pumping |
| Inst. for Imbeciles | Shallow wells | None | Pumping |
| Tuberculosis Sanitarium | Spring and well | Filtered | Pumping |
| Inst. for the Blind | Salem Water Company's service | None | Pumping |
| Penitentiary | Wells on penitentiary grounds | None | Gravity |
| Reform School | Baker Spring; also Mill Creek | Filtered | Pumping |
| School for Deaf Mutes | Salem Water Company's service | None | Pumping |
| Fair Grounds | Well on grounds; also Mill Creek | Filtered | Pumping |
| University of Oregon | Eugene's city water service | None | Pumping |
| U. S. Indian School | Well on school grounds | | |

### Cost of Construction

The matter of probable cost of constructing the proposed Clear Lake water supply system has been carefully considered with reference to approximate quantities and classes of materials and labor and their cost, and I have determined the following as conservative estimates for a complete main-supply pipe line from Blue River, the proposed place of diverting Clear Lake water, to Salem, a distance of 116 miles:

| | |
|---|---|
| If continuous wooden-stave pipe construction | $3,900,000 |
| If steel pipe construction | 4,900,000 |
| If reinforced concrete pipe construction 25 miles at upper end and remainder of distance to Salem wooden pipe | 4,000,000 |
| If reinforced concrete pipe construction 25 miles at upper end and remainder of distance to Salem steel pipe | 4,800,000 |

To construct the main supply pipe line of cast iron would involve a cost amounting to an almost prohibitive sum. The other classes of construction upon which estimates are based are suitable, and as experience has shown, either wood or steel pipe, or reinforced concrete pipe at the upper end, would be durable and satisfactory construction.

### Sources of Revenue

Of course, each municipality composing the district to be supplied with Clear Lake water should have opportunity to vote on the question of issuing bonds to pay the cost of constructing the system.

In recommending that the construction of the Clear Lake water-supply system be undertaken by the joint efforts of the state and the municipalities affected, it is suggested that the state for its institutions and the cities and towns work out independently the problems of finance relating to the taking over, extending and improving of existing distributing systems within their respective corporate limits or of constructing new distributing systems, including distributing reservoirs, and maintaining them.

Regarding probable revenues from the proposed Clear Lake water-supply system, there is no reason why the revenues from water consumers based on liberal rates, could not easily pay the interest on bonds, and sinking fund requirements for ultimately retiring bonds, together with the annual expense of maintenance and operation of both main-supply pipe line and distributing systems, besides leaving a surplus for extensions and improvements to distributing systems.

Under the plan of operation of the Metropolitan Water and Sewerage Board in Massachusetts, the annual bond interest, sinking fund and maintenance requirements are assessed upon the several municipalities, one-third in proportion to the several assessed valuations and two-thirds in proportion to the quantity of water used in each municipality during the preceding year. This feature might be adopted in the plan of organization and operation of a similar board here.

### Utilization of Water Power

Comparison of elevations of some of the important points mentioned in this report demonstrates the feasibility of delivering Clear Lake water by gravity under suitable pressure (87 pounds) to the Willamette Valley cities and towns proposed to be supplied with this water.

These elevation are as follows:

| | *Feet.* |
|---|---|
| Clear Lake (approximately | 3,100 |
| Blue River (approximately) | 1,100 |
| Eugene | 426 |
| Salem | 163 |

The difference in elevation between Clear Lake and Blue River is 2,000 feet. All of this distance will be covered, it is assumed, by the pipe lines of the proposed hydro-electric power developments. From Blue River, the proposed point of diversion for the community water supply (at the tail-race of the lower power plant) to the City of Eugene, there is ample head to enable the delivery of water at Eugene at a pressure of 87 pounds. It is feasible to deliver the water to the principal municipalities named in this report at a similar desired pressure which is ample and about the same pressure as normally obtains in the City of Portland.

### Place of Proposed Diversion

The fact that the McKenzie Valley Irrigation & Power Company contemplates bringing the water of Clear Lake and the upper McKenzie River in pipes (the flow

to be undiminished in quantity and undeteriorated in quality) from the lake outlet to Blue River, a distance of 30 miles, for power purposes, requires that it be proposed to divert such portion of the river's flow as may be required for the community water-supply at a point just below the tail-race of the lowest of the four power plants.

### Classes of Construction Considered

From this diversion point it is proposed that the water will be conveyed down as far as Salem thru a continuous wooden-stave pipe similar to that used in the Seattle and Denver water-works systems, or a steel pipe line similar to that constructed from Bull Run River for the City of Portland. As an alternative, a reinforced concrete conduit could be constructed at the upper end of the line where the head is not excessive for that class of construction.

The total length of main-supply pipe line from the diversion point to Salem would be approximately 116 miles.

The main-supply pipe line would vary from 44 inches to 36 inches, internal diameter.

### Quantity of Water Deliverable

Under the state condition of size of pipe and head (differences in elevations) the tentative plan recommended is for the construction of a pipe line having a capacity of 46 second-feet, which will deliver 30,000,000 gallons daily to the Willamette Valley communities.

Based on a consumption of 150 gallons daily per capita, which is a liberal allowance, this would be ample supply for 200,000 persons.

Assuming the estimate of 200,000 population to be served in 1940, about 25 years hence, might be less than the total population then, the amount of water delivered (30,000,000 gallons) would still be ample for all purposes if the cities installed meters in the distributing systems. Serving water thru meters effectively conserves water supply and prevents waste, particularly in summer when consumption is greatest.

CLEAR LAKE, *Looking Southeast.*

# IDEAL PLAYGROUNDS

*By Dr. A. W. Dunning, St. Paul, Minn.*

THE ideal playground is essentially a piece of ground sufficient in size to accommodate all of the children of a neighborhood within a radius determined by reasonable accessibilit. This is pretty accurately indicated by the boundaries of the school district. This ground is to be adequately enclosed to facilitate control by the play leader, and to afford protection against depredations from without. The enclosure is enhanced by at least a five-foot border of planting, which lends a touch of nature to the setting. Add to this a minimum of apparatus, sand piles and wading pools for the little tots with ample shade and numerous swings. For older children add a few simple pieces of apparatus, bats and balls, footballs, quoits, tennis racquets and balls and other outfits for the organized games, and you have the setting for a playground of the first or simplest class. But the most essential factor is still lacking, i. e., the play leader. I say the most essential factor advisedly; for without a proper play leader all this does not constitute a playground, any more than a fine house without furnishings and a home-keeper constitutes a home. A playground without proper supervision and leadership is sure sooner or later to foster vice among its patrons, and it becomes a menace to the community rather than a benefit. But install in that ground a woman or a man, or both if possible, who have in full measure the love for children and for child life in their hearts, and added to that a training in the varied arts pertaining thereto, and you have established an institution whose influence for good in the community is second to none.

Elaborating upon the plan sketched above we formulate a playground of the second class, made possible only where a space of some ten acres is available. The chief difference lies simply in the addition of the larger field games, basket ball, football, baseball, tennis, croquet and many others which, together with more elaborate outdoor gymnasium apparatus, make it suitable for boys and girls thruout the grades.

For the playground of the third class, or the athletic field, a space of twenty or more acres is desirable and this should be treated so as to afford every facility for the organized sports of the boys and girls of high school age, and for these numerous organizations for field games among the working men and boys thruout the city. Each of these grounds of the second and third class should, of course, be under the control and leadership of a man whose personality and training fit him to guide his followers in clean sport, manly bearing and the practice of the square deal at all times.

*A New York City Playground; one of the first class*

The ideal provision for playgrounds in a city would place at least one in each grade school district, preferably adjoining the school yard. This would mean some sixty playgrounds of this class in St. Paul. Then there should be one of

the second class so located as to accommodate each group of, say four to six schools, and lastly one of the third class in each of the principal divisions of the city and its suburbs. In St. Paul this would mean at least three of the latter class.

Thus far I have said nothing about parks, for the central idea of my discourse has been the individual small citizen, and the influence upon him of his environment. However, I would treat every playground as a park so far as possible, i. e., by the planting of trees and shrubs, flowers and grass in every available space that could be spared from its utilitarian purposes. I would make each playground as beautiful and attractive as possible, both to the children and to the older people of the district. Then too, every city park should be a playground in the broadest sense. The first function of a park should be to provide real recreation for young and old alike while at the same time presenting such beauty of landscape, tree, flower and shrub as to furnish a powerful uplift to the better side of man's nature.

The tendency in modern city building is more toward utilizing the parks for the comfort of the people, and less toward making them mere beauty spots with warning to "keep off the grass" on every hand. The plan of developing a system of parks and playgrounds combined, is perfectly practicable, and this is done very satisfactorily in some cities. Much has been said and done, of late, relative to school gardens for children. Here again is a splendid institution for development of the better side of child life, a love for growing things, while at the same time fostering habits of industry and the ability to produce something directly from the soil. The value of this experience in the lives of the children and youths of a city community is undoubted and its measure is beyond computation. The enterprise was started by another group of earnest people who have the zeal and ability to demonstrate its value. As the plan develops it should become a recognized factor in our municipality, and so correlated as to take its proper place under the department of child development. Thus will be furnished

TAMALPAIS *Recreation Center, Kentfield, Cal.*

WADING BASIN, *McKinley Place Playground, Cincinnati, O.*

another means for work to alternate with play in a most desirable form.

One of the most difficult problems to solve in connection with the public playground is its proper relation to the school, and the best plan for its supervision. Leading educators everywhere are heartily in favor of the playgrounds, and urge that they be made a part of the school system, financed by the boards of education, and that the play leaders be furnished from among the teachers.

This would seem the most natural and economical plan, but when one considers the already overworked teachers and the proverbial difficulty which school boards everywhere encounter in getting funds to carry on purely educational work, one finds that it does not work out well in practice, as is evident in several large cities where this plan has been tried.

Many close observers agree, therefore, that for the present, at least, it is best that they should be financed and supervised by a separate body, such as the park board or an independent recreation commission, but working in close co-operation with the teachers so as to supplement their work in the highest degree possible.

The problem of financing is always a difficult one. The protest is going up all over the country that the bonded indebtedness of cities everywhere, is becoming too great. This protest comes, not alone from the grudging taxpayer, but from careful students of civic welfare and from serious minded business men. Very naturally, under these conditions, a proposal such as I have made above; to establish a complete system of playgrounds, entailing the purchase of land, costly apparatus and adequate buildings, as well as the employment of a large number of high grade people upon salary, and thereby establishing a heavy fixed charge for all time; brings forth a vigorous protest from the men who control public affairs in our city, and we are called visionary, and exceedingly impracticable. But look at this matter from another angle for a moment and tell me who is the most practical man. My thesis, which is supported by sociologists, educators and close observers everywhere, is this: The playground for children is a most powerful factor in the upbuilding of the health, character and spirituality of the coming generation. In doing this it tends to lessen the needs for hospitals and all institutions for defectives, to lessen intemperance and poverty, thereby saving untold cost of almshouse, jail and court. Thus it requires no visionary temperament to conclude that my proposition would prove an excellent investment in money alone. It seems to me that he who proposes to apply the effective measure of prevention, in early child life, is like the man who carries the bucket of water to extinguish the incipient blaze and thereby prevents the conflagration; while

THE GAME *that makes for the square deal; part of a playground of the second class.*

FINISH *of a close dash; a glimpse of an athletic field of the third class.*

he who would pour in large sums of money to provide institutions for the care of the disabled and delinquent classes after gross neglect in child life, is like the man who spends his energies in pouring buckets of water on the fully developed conflagration. Which is the more practical man?

This question of finance is a vital one and must be decided by the people. It is like all other questions of great public interest; when once the people realize the actual value to the race of the institution of the public park and playground, the means will surely be forthcoming.

The boys and girls of today are the men and women of tomorrow, and the public playground, properly equipped and directed, is one of the very strongest agencies in building citizens of character, health and independence.

PARK PLAYGROUND *in Troy, New York.*

# EDITORIAL

## ROAD SURFACES, FOUNDATIONS AND THE TRAFFIC CENSUS

Thus far in our road experiences we have been groping, trying to find out what was the reason for each failure in road construction which has developed, and then improving the road to meet our idea as to the cause of the difficulty. We have now gathered a considerable amount of data and are adding to the collection daily.

Some of the information is as old as the Romans and still we have not learned to apply it rationally because the data necessary to fill the gaps in the course of reasoning are only now collecting.

The old Roman roads had heavy foundations. The French roads have heavy foundations. Both are noted for their durability, the French roads requiring only the constant patrol system to keep their surfaces in good condition until the modern traffic has changed the conditions on the main roads. English roads have less strength in their foundations, the lower layers being of broken stone rather than of heavy blocks, except where Telford's system has been followed. American roads have foundations still less stable than English roads, when considered as a class, and many roads built under the county system have little or no foundation.

The consequence is that the cost of maintenance of American roads is out of all proportion to the amount of traffic over them, and we are only just learning the lesson which was set for us centuries ago. The tendency toward better drained and heavier foundations for all roads is becoming stronger every year. As the foundations improve the cost of maintaining the surfaces of the less traveled roads diminishes, and we will, one of these days, be able to select the most economical foundation for the traffic to which the road is to be subjected.

Main roads have an additional reason for rapid wear in the modern traffic, to say nothing of the increase in traffic. The difference in effect of the local traffic and the main road traffic is demonstrated on the French roads. The local roads are generally in good condition, tho having lighter foundations and less constant attention, but the main roads, tho costing four or five times as much per mile for maintenance, are rapidly approaching the time for reconstruction.

This modern traffic developed first in the fast moving automobile. But this is followed by the automobile trucks and the conditions are again changed. A treatment of the surface which would prevent raveling under the automobile was first considered sufficient, but the heavier traffic now demonstrates again the necessity of heavier foundations and the tendency now is toward them, even to the extent of making them of concrete on the most heavily traveled roads. The next step, to more permanent surfaces, is then easy to take and in the vicinity of large cities we have the concrete foundations and brick or cement concrete or bituminous concrete wearing surfaces.

The modern tendencies are therefore toward better foundations for all roads subject to traffic of any weight beyond pleasure vehicles, and heavy foundations for the heavily traveled roads. As regards wearing surfaces there is a tendency toward the old macadam or gravel top layers on the better foundations for all the lighter traffic roads; dust layers for those traveled largely by pleasure vehicles, and permanent surfaces for the heavily traveled roads. Roads under intermediate conditions are built by using the various methods of applying bituminous binders.

There are many mistakes made daily in selecting the proper materials and methods of construction for new roads, because of lack of definite knowledge of the actual conditions of traffic and of poor judgment as to the effect of the improvement of the road in attracting more and heavier traffic. The only way to lessen the number of these mistakes is to gather the necessary information. One of the most important methods of collecting data is the traffic census, which should include not only the number of vehicles, but their kind, weight, speed, kind of tires, method of propulsion. This material should be supplemented by a study of the effect of a similar improvement upon another road in similar location, with a careful comparison of the respective chances for new traffic from various sources, so that there may be a reasonable chance for accuracy in predicting the kind and amount of traffic to which the road will be subjected.

New road commissions are likely to follow the demands of their constituents in their early work and thus throw discredit on the good roads cause by building roads which will be barely, if indeed they are quite, sufficient for the conditions of the past, only to see them go to pieces promptly under the new traffic to which they are bound to be subjected. The older commissions have gone thru that stage and their troubles should teach the newer commissions their lessons. Will they learn them easily or only by passing thru the whole of the experimental stage?

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## HIGHWAY LEGISLATION

Many legislatures are closing their sessions as this number of MUNICIPAL ENGINEERING goes to press or will shortly do so. Most of them have done or promise to do well by their country roads. The Indiana legislature completed its work early in March and with great difficulty succeeded in passing a law making it possible to establish in each county the patrol system on county roads under the supervision of a single county road superintendent who can be as competent as the county commissioners desire within the limits of the compensation of $4 or $5 a day. Another law providing for the payment of township road taxes above $20 in amount in cash will help to eliminate from future legislative sessions the lobby against all road legislation which might interfere with the small group of men who made much money in farming out the road taxes of railroads and other corporations and may make it easier to pass progressive road laws at future sessions. The same law provides for the appointment by township trustees, instead of the election, of township road supervisors, making them responsible to the township trustee and thus giving him an opportunity to improve the road situation in his township if he desires. No state highway law could get thru, not even one providing a commission to report to the next session. One of the best bills on that subject which has been presented to any legislature was up for consideration, but could not be passed because the county members could not understand it and feared that it would interfere with their local control of roads, altho no provision in it could be so construed, except so far as the few miles of road to be constructed with state aid were concerned.

# *MEN PROMINENT IN MUNICIPAL AFFAIRS*

Photo by Moffett, Chicago.

PAUL E. GREEN, *Consulting Engineer.*

## Paul Evans Green

*Consulting Engineer, Chicago, Illinois*

Paul E. Green, Consulting, Civil and Sanitary Engineer, member of firm, Aetna Engineering Bureau, Chicago, Illinois. Graduate of the University of West Virginia 1899; 1899 to 1905, engaged on railroad bridge and valuation work; in 1905, engaged on design of hydraulic work by the state of New York in connection with the construction of barge canal between Lake Erie and the Hudson river.

In 1906, Mr. Green entered the employ of the city of Chicago, as Division Engineer in charge of the construction of

street pavements in the north district, embracing all territory north and east of the Chicago river to Devon avenue, with a population of approximately 400,000 people.

This work included the supervision of all streets paved by special assessment and private contract; preparation of preliminary reports on proposed improvements, preliminary estimates and separate plans and specifications for each street and alley to be paved; entailing an expenditure of some $1,000,000 annually.

In 1910, he resigned his position with the city of Chicago and entered upon his present duties. Since becoming a member of the firm with which he is now connected, Mr. Green has had charge of many engineering projects thruout the country, the more important of which are: Investigation and report as to the improvement of Sheridan road from Chicago to Lake Forest, Illinois, involving an ultimate expenditure of several millions of dollars; special expert work for Chicago in connection with pavements damaged by street car traffic; Elyria, Ohio, examination and report on revision of water works plant and installation of high pressure system; Longview, Texas, design and construction of street pavements, storm water sewer system, electric light system and concrete bridges.

He is a member of American Society of Civil Engineers, Western Society of Engineers and Illinois Water Supply Association.

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## J. T. Miskeal, Purchasing Agent for Memphis

The great loss due to the buying of supplies for a city by separate departments without the co-operation of other departments has been very successfully overcome by the city of Memphis, Tenn. As a result of the co-ordination of all purchases through one purchasing department the city has saved many thousands over the old prices and, just as important, has been the keeping of departments properly supplied at all time, thus eliminating a large waste in the time of men due to unnecessary waiting for stock.

When the commission government was inaugurated, a purchasing agent was appointed who had spent many years in the employ of one of Memphis's largest wholesale houses as a buyer. This experience equipped him with a keenness and ability which few cities have the good fortune to command for their own benefit. The many efficiency methods established by Mr. Miskeal have placed the purchasing department of Memphis on a par with the methods used and results attained by some of the largest business corporations in the country. The buying of supplies

J. T. MISKEAL, *Memphis, Tennessee.*

to keep 133,000 people protected in health, physical safety and mental well being—purchases for police, fire and engineering departments, purchases necessary to keep streets clean, properly dispose of garbage, to operate the city buildings, to keep parks in such condition that they may be a joy to the people, all entail an amount of detail that only a man of ability and executive capacity can effectively handle. That Mr. Miskeal has such qualifications is exemplified in his compact and efficient organization, which, with the exception of a number of clerks, is handled by himself and his assistant, Mr. Dave Wells.

Under the plan now in force every purchase made for the city must be covered by a requisition approved by the head of the department ordering it. These requisitions are carefully examined and the need investigated by the City Commissioners before official approval is given. The properly authorized requisition is then passed on to the city purchasing agent. This, very briefly, illustrates the fundamentals of operation. However, there are in force in the purchasing agent's office many efficient and unique methods of cataloguing prices for immediate reference, systems whereby deliveries are checked and orders followed up for prompt delivery.

The purchasing department receives bids on all supplies, materials and so forth and the order is given to the firm quoting the lowest price, quality considered. As a result of this method business houses have learned to quote the city the same low prices that they would

any other class of trade in which competition is keen.

The department has paid for itself many times over. Not only has it brought about a great saving in the cost of supplies, but the system has also effected a great economy in the operation of all departments of city government. This is largely due to the fact that city employes are no longer permitted to pick up the telephone and order supplies indiscriminately from any one they choose and at any price that may be quoted at the time.

## William D. Barber

*Assistant Engineer, Department Public Works, Chicago, Illinois*

William D. Barber, member American Society of Civil Engineers, Assistant Engineer, Department Public Works, Chicago, Illinois, was graduated from the University of Illinois in 1892, with the degree of Civil Engineer. After four years' experience as Construction Engineer with

WILLIAM D. BARBER, *Chicago.*

the George A. Fuller Company, high building contractors, Mr. Barber entered the services of the city of Chicago as Engineer of Construction.

He was placed in charge of Section 3 of the Northwest Land Tunnel, consisting of 4½ miles of brick tunnel, 8 feet in diameter, constructed thru rock.

In 1899, Mr. Barber was placed in charge of the Construction and Repair Division of the Department of Public Works. Here he had charge of carrying on such repair and construction work as was done by the city. The plant then consisted of a brass foundry, an assembling room, a machine shop, a pattern shop, a carpenter shop and a cabinet-making room, which was sadly in need of an expert on organization and efficiency.

Recognizing the importance and future possibilities of such a plant, Mr. Barber made a thoro study of the organization, equipment and existing conditions, and proceeded to remedy, so far as was in his power, the more glaring defects, the result being that, today, the plant will compare favorably with any of its kind in the country.

In 1908, he was placed in charge of the construction of the Blue Island Avenue Land Tunnel, constructed thru rock and earth for the purpose of supplying the southwest portion of the city with necessary water facilities. This tunnel consists of 29,569 lineal feet concrete-lined tunnel, varying in diameter from 6 feet to 8 feet.

Since 1910, Mr. Barber has been in local charge of pumping station improvements and betterments, special work on intercepting sewers and the organization and direction of municipal employes engaged in construction work.

## The Chattanooga Municipal Record

When the new Board of Commissioners of Chattanooga, Tenn., assumed charge of the government of the city, they established the "Municipal Record," now in its second volume, under the provisions of the act creating the commission. The paper is compiled and issued by the Department of Public Affairs and Finance, Hal F. Wiltse, the secretary to Mayor J. C. Thompson, who is the head of the department, doing the editorial work. The publication is of much value to taxpayers and voters.

## Cement Trade With Foreign Countries

Cement imports during 1912 were less than half what they were in 1911. They have fallen to about 68,000 barrels a year, as compared with a maximum of about 3,000,000 barrels a few years ago.

Exports of American cement increased 25 per cent and were 4,215,532 barrels in 1912, as compared with a few thousand a few years ago.

In fifteen years this reversal of trade has taken place, due to the development of cement manufacture in this country.

# QUESTION DEPARTMENT

## Form of Charter for Small City

We have under consideration a city charter, which will include three villages with an estimated population of 10,000. Any information that you have in this matter will be greatly appreciated by us.

F., Village Clerk, ———, N. Y.

The National Short Ballot Organization, New York City, and the National Municipal League, North American building, Philadelphia, Pa., have paid considerable attention to the subject of city charters and will doubtless give all the information they can on request.

MUNICIPAL ENGINEERING has had a good many articles in the past on this subject, and particularly the articles in vol. xliii, p. 105; vol. xli, p. 257, and vol. xl, pp. 30, 45, 124, 126 and 127. These may not give exactly what is wanted, but they discuss various phases of the subject, which would probably be of value in working ou the principle on which a new charter should be based.

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## Properties of Slag Concrete

Will you kindly give us information regarding the use of open hearth slag, ground up or pulverized and mixed with good portland cement, its heat conductivity and what its tenacity and strength is?

J. B., Cincinnati, O.

In vol. xlii of MUNICIPAL ENGINEERING, p. 119, is a brief article on the subject, which indicates that slag is approximately as good for concrete as limestone. One man who has made many experiments on slag sand declares that mortar made with it, has from 10 to 36 per cent greater tensile strength than mortar of same proportions using river sand. In his experiments he shows that slag concrete compares favorably with concrete of other standard materials in compressive strength. Slag and cinder are fire-resistive materials and their heat conductivity is low on account of the voids in those materials, but when they are mixed with Portland cement, these voids are more or less filled by the cement and so the heat conductivity is increased. This is indicated by the greater percentage of increase of weight of cinder concrete over the cinder itself than of limestone concrete over the limestone itself. Cinder and limestone when compared show that the weight and the compressive strength of the cinder concrete are from 60 to 65 per cent of that of the limestone concrete. Slag concrete would probably have both weight and strength more than cinder concrete, but no one has as yet taken enough interest in the subject to make any long series of experiments. Slag is used in the concrete for the foundation of pavements in a number of places where it is available, and is used very successfully, but its use is restricted necessarily to the vicinity of the mills of which it is the product.

Can our readers supply any additional information of value?

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## History of Brick Paving and Fillers

Will you kindly state where and when vitrified brick paving is first known, in this country at least, with a brief resume of the course of development of fillers for the brick to the present, and with more particular reference to expansion provisions in filling with cement?

Are there anywhere reports of experiments or experience with placing the brick diagonal rather than right-angled to the line of street?

V., City Engineer, ———, O.

The credit for the first use of brick as paving material in this country is claimed by Charleston, W. Va., with a sample in 1870, and a block in 1873 and by Bloomington, Ill., with considerable area laid in 1875. These pavements used sand for filler. By 1895, when Wheeler's little book on "Vitrified Paving Brick," appeared, tar or pitch and cement had been added to the list of fillers, Wheeler expressing his preference for cement as building the pavement into a monolith and not being affected by hot weather.

When the first edition of Baker's

"Roads and Pavements" appeared in 1903, sand was still the most common filler and cement was next. He describes in detail the difficulties from expansion, but it is evident that the use of expansion joints along the curb is not common, for he suggests that the rumbling of the pavement can be prevented by such joints filled with tar. He also suggests transverse joints filled with tar at intervals and gives instances of the amount of material used.

One of the pavements, South Sixth street in Terre Haute, laid some twenty years ago, which still has a perfect surface, cement filler, had no expansion joints and would undoubtedly have failed from expansion if the soil had not been light enough, so that the curbs were pushed back the necessary amount. Since that date, but more particularly in the last ten years, the stress laid on proper workmanship has gradually brought the quality of brick pavements with cement filler up, and the curb and other construction has also improved, so that the necessity for expansion joints along the curb has become more apparent and they are now carefully specified. Some engineers have made careful specifications for them almost from the beginning, but they are now important parts of the generally adopted standards.

The subject of transverse expansion joints is fully discussed in recent numbers of MUNICIPAL ENGINEERING, vol. xliv, p. 96 on "Prevention of Defects in Brick Pavements," p. 106 on "Brick for Country Roads," p. 114, "Good Brick Pavements."

Mr. Baker reports, in the book referred to, that a few cities lay bricks at 45 degree angle, but considers that there is no advantage in this and some disadvantage in laying. Observation of intersections, which are laid diagonally, partly to prevent driving lengthwise of the bricks and partly because vehicles turning the corners follow approximately the perpendiculars to the courses, indicate that the wear is more rapid and less uniform over such diagonal courses.

Bituminous fillers have also improved and some engineers prefer them to any other.

## How to Keep the Accounts of a Municipality

I would like very much to get information concerning the best methods of keeping the accounts of a municipality. Is there any regular system in general use, and is there any that would be simple and yet complete that you could recommend? I am both city clerk and tax collector, and have more than I can attend to under the present system.

G., ———, Tex.

The state of Massachusetts has done much in standardizing methods of keeping municipal accounts. Information can probably be obtained from the State Bureau of Statistics, at the State House, Boston, Mass.

Ohio has established a State Bureau of Accounts, which has supervision over the forms of accounts and reports of all the municipal organizations in the state, city, village, county, township, etc., and the chief of this bureau at Columbus, O., can supply much information in his annual reports and otherwise. Blanks and books for the accounts and reports are made by publishers and sold to the municipalities, which conform with the requirements of the bureau, and names of such publishers can be given by the chief of the bureau.

The State Bureau of Accounts of Indiana has also done something in this line, although most of this work has been with township and county officers.

Books on the subject are "Municipal Accounting," by F. H. Macpherson, which gives forms for books of all sorts, published by the Bookkeeper Publishing Co., Detroit, Mich., in 1901; "Quasi-Public Corporation Accounting and Management," by John F. J. Mulhall, treating mainly of water works bookkeeping and accounting, but covering other public service utilities.

## Articles on Use of Cement Concrete for Street Paving

I desire to secure a list by title and subhead of any articles which have appeared in MUNICIPAL ENGINEERING since about 1897 relating specifically to straight concrete (base and topping) for paving. SUBSCRIBER.

Following is a list of such articles:

In vol. xliv: "The Thomas System of Reinforced Concrete Roads and Pavements," p. 158.

In vol. xliii: "Concrete Roads, What They Cost," p. 44; "Thomas Steel Reinforcing for Pavements," p. 342; "Patents on Road Construction and Repair," pp. 102, 127; "Qualities of Concrete Pavement," p. 255, giving references to earlier articles; "Specifications for Concrete Street Pavement, p. 253.

In vol. xlii: "The Blome Concrete Pavements," p. 340; "Comparison of Cincinnati Pavements," p. 458; "Patents on Road Construction and Repair," p. 68.

In vol. xli: "Mixing Concrete for Street Paving," p. 50; "Patents on Road and Pavement Construction and Repair," p. 410; "Paving in Mason City, Iowa," p. 461.

In vol. xl: "Reinforcement for Concrete Pavements or Floors," p. 223; "Cement Concrete Paving in Mason City, Iowa," p. 174.

In vol. xxxix: "Fond du Lac's Cement Streets," pp. 136, 284; "Street Paving in New Orleans," p. 260; "Concrete Pavement in Delphi, Ind.," p. 294; "Concrete

and Macadam Streets of Richmond, Ind.," p. 281; "Expansion Joints in Concrete Pavement," p. 213.

In vol. xxxviii: "Specifications for Concrete Sidewalks, Curbs and Gutters and Pavements," p. 244; "Articles on Concrete Paving," p. 419.

In vol. xxxvii: "German Artificial Stone Paving," p. 121; "Patents Concerning Street and Road Construction and Repair," p. 277; "Will a Concrete Street Crack," p. 35; "Cost of Street Paving," p. 177.

In vol. xxxvi: "Efficiency of Concrete Pavements," p. 32.

In vol. xxxv: "Cement Macadam Streets in Germany," p. 36; "A Concrete Pavement in Bozeman, Mont.," p. 389; "The Blome Concrete Pavement," p. 369; "Experience with Concrete Pavements," p. 180; "Concrete Street Paving in Allentown, Pa.," p. 254.

In vol. xxxiv: "Information About Concrete Pavements," pp. 168, 237; "Concrete Street Pavements," p. 357; "The Evolution of Pavements," p. 336; "Municipal Engineering at Gary, Ind.," p. 329.

In vol. xxxiii: "Concrete Pavement in LeMars, Iowa," p. 412; "Patents Concerning Roads and Pavements," pp. 134, 284.

In vol. xxxii: "Concrete Pavements," p. 89; "The Hassam Pavement," p. 252; "Concrete Brick for Street Paving," p. 317.

In vol. xxxi: "Specifications for Cement Street Pavements," p. 102.

In vol. xxx: "Specifications for Brick and Concrete Alley Pavements," p. 430; "Concrete for Steep Streets," p. 202.

In vol. xxviii: "Concrete Paving and Paving Materials," p. 386.

In vol. xxvii: "Concrete Pavements in Toronto, Can." p. 350.

In vol. xxiii: "Some Concrete Constructions in Grand Rapids, Mich," pp. 400, 436.

In vol. xix: "Cement Streets in Bellefontaine," p. 427, also in vol. xvii, pp. 383, 384, and vol. iv, p. 229.

## Responsibility for Errors of Engineer

Our water supply was inadequate. An engineer came here and made a preliminary survey. Then he came back after the city council had told him what system they wanted to work under. By contract the engineer agreed to "lay out the work for the successful bidder, and, when work has been installed by said bidder, inspect the same, and if it is found in accordance with the plans and specifications, the work to be thoroughly tested and approved and turned over to parties of the first part."

He came here, but did not lay out anything except on blueprints, and commenced to O. K. every estimate sent in by the contractor. A lot of defective pipes were sent out, marked "personal inspection," which were weighed and found far below what the plans called for. Personally he came out here and approved some cement beams, and when the forms were taken off they fell of their own weight. The cement beams were worthless. By this time the engineer had been paid about $500. The council then discharged him. Another engineer took charge. He found plans very deficient, and when he investigated he learned that two of the Cook points had been stuck in blue shale or mud and were a loss to the city of about $500. Hardly a year had passed until the city faced another water famine. A big well had to be dug at a cost of $4,500. The engineer who drew the plans never made any test holes where the Cook points should be placed. Our district court held that he was not obliged to make any test holes; was not required to make any estimates, and if he was careless or negligent in this respect the city could not hold him, for this part was only voluntary and was beyond his contract. And that if he furnished plans, on blueprint, and made final inspection and the city accepted, engineer was entitled to balance due, $365. They accepted the work and that settled it.

H., City Attorney.

The engineer under city employment is apparently on the same basis as a city official, especially after his work has been accepted by the city officials, and consequently he is not held for errors of judgment any more than city officials are.

There might be conditions demonstrating fraud which would modify this general condition, but they must, of course, be brought out on the trial. There seems to have been no decision to any other effect. Have our readers any knowledge of court decisions on this question?

## Durability of Concrete Pavement With Asphaltic Concrete Wearing Surface

Can you furnish usable data as to cost and durability of pavement of 4 or 5-inch good cement concrete base, with 2-inch asphalt concrete wearing surface, both base and top to be made with good hard washed gravel, two to three parts good sharp sand to five of gravel? Some parties desire such pavement on a certain street instead of brick, but such pavement is, so far as my acquaintance goes, experimental, with no doubt its own peculiar problems to be solved. If you can furnish data or refer me to some one who has used such or similar pavement long enough to give it a fair trial, I shall thank you.

N., ———, Ill.

The writer has not had personal experience with exactly the kind of pavement described and does not know where it has been used, altho pavements of about the same description using broken stone in the asphaltic concrete, have been used with reasonable success. Contract has just been let on elaborate specifications for this sort of pavement in Schenectady, N. Y., which were in use in Milwaukee for two years previously.

Will our readers give any information which will help our correspondent and others?

## How to Make a Municipal Budget

I am particularly anxious at this time to secure information relative to budget-making for this municipality, and if you have

any information along this line, or can give me any information relative to the drafting of a budget, I shall very much appreciate your kindness.

S., Mayor, ———, Md.

Much of value on this subject can be obtained from the Bureau of Municipal Research, New York City, and the National Municipal League, North American building, Philadelphia, Pa. Both of these organizations have paid considerable attention to budget making and can give much assistance on the problem. The Bureau of Municipal Research has brought about a great reform in the matter of preparation of the budget for New York City, which is much larger than this city, but it has extended its energies into other smaller cities, so they will be able to give what is wanted. The National Municipal League has discussed the subject in its annual conventions and the secretary can at least supply the annual volumes of proceedings containing material of interest in this connection.

MUNICIPAL ENGINEERING would like to publish the results of such efforts as this. Not many cities pay any attention whatever to their budgets. Some of them really apply the proper principles, but in such a loose way that no one can ascertain just what the basis of their work is. Others simply live from hand to mouth. The experience of any city will be of interest to our readers and will be published if sent for that purpose.

## Expert Wanted to Test Electric Light System

This city desires to employ one or two good men to test the candle power of the street arc lamps and to determine the cost to maintain and operate same.

G., City Attorney, ———, Ky.

This request is referred to our readers.

## Makers of Garbage and Refuse Destructors.

Kindly inform me as to names of manufacturers of crematories and incinerators, etc., for disposing of garbage, street cleanings, dead animals, etc., such as will accumulate about a city.

Our city will have to make arrangements for a new plant at an early date, and I have been asked to secure information.

W., ———, N. C.

Reference may be made for the names of such manufacturers to the Business Directory published in each number of MUNICIPAL ENGINEERING under the heading, "Garbage Disposal Plants." The magazine has much on this subject, the current volume containing, "Garbage Disposal in Canton, O.," p. 141; "Garbage Reduction in Chicago," p. 137. Other plants are described in previous volumes.

## Repaving Asphalt Street With Brick

Will you kindly inform me if you have any records of or references to the use of vitrified brick for repaving asphalt streets and the methods for laying same. Also, what depth of brick has been used? If possible, will you also give me the names of any cities where such construction has been used?

S., City Engineer, ——, N. Y.

Can our readers refer our correspondent to cities doing what he proposes?

The brick is thicker than the asphalt wearing surface, especially when a sand cushion is used. If it is possible to reduce this sand cushion to a minimum, it might be possible to relay the brick pavement parallel to the concrete foundation with the exception of the gutters. These might be laid at or near the present elevation so as to interfere as little as possible with the drainage of the street, and a row of beveled brick might be used to make the connections between the pavement proper and the gutter. Perhaps it would be well to construct the gutter and this beveled section of cement, so that it would make a straight line between the cement gutter and the brick pavement. Otherwise it probably would be necessary to produce the beveled surface on some of the brick used in breaking joints by chipping brick, which would not be a very satisfactory operation.

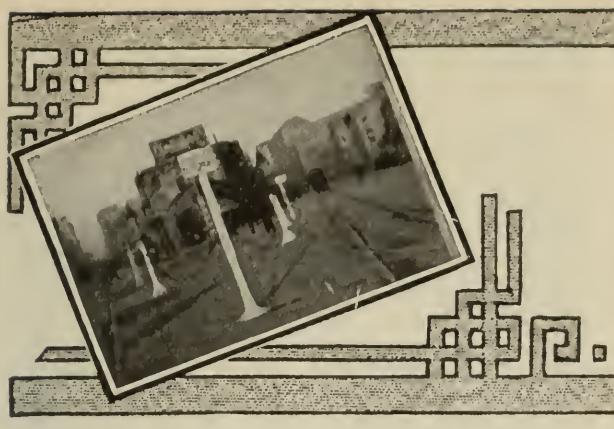
## Mileage of Asphalt Pavements

If you have any data relative to the total mileage of standard asphalt pavements laid in the principal cities of this country, I would greatly appreciate if you would supply me with this information.

H., Inspector of Asphalts and Cements.

The best place to get information on this question is in the special reports of the United States Census Bureau. This bureau publishes occasional volumes of statistics of cities. The financial statistics are collected annually, but the last volume of other statistics is that for 1907 for cities of over 30,000 population.

According to that publication there are in cities of over 30,000, 75,437,652 square yards of asphalt pavements. If we assume the average width of street to be 30 feet, this would make the mileage 4,286. Of this amount 47,000,410 square yards are in cities of over 300,000, 15,295,187 in cities between 100,000 and 300,000, 8,478,411 in cities of 50,000 to 100,000, 4,663,644 in cities of 30,000 to 50,000. These figures include asphalt blocks, but as the proportion of the blocks is small, it makes but little difference in the total.



# WORKERS IN THE FIELD

## Cause of Flooding of Batavia Sewage Pumping Plant

The Editor of MUNICIPAL ENGINEERING:

Sir—The recent trouble at the Batavia sewage pumping station has, for a reason apparent only to a few, called forth undue criticism in recent periodicals. It is due to the engineering profession at large that a true statement of the cause should be placed before them.

The system here comprises 32 miles of separate sewers draining to a central pumping station. These sewers range from 8 inches to 27 inches in diameter and to a maximum depth beneath the surface of 23 feet. The geological formation in the village is glacial, with its topography nearly level. The glacial drift has been deposited in a very irregular and uncertain manner. The valley ways were originally swampy. The Tonawanda creek flows thru the village and, in times of spring freshets, overflows its banks. The ground water level averaged 5 feet beneath the surface at time of construction, resulting in shallow, yet wet, cellars. The result of the above conditions was that four-fifths of the sewers were constructed in water-bearing material, with a possible large infiltration thru the joints of the sewers.

### Infiltration of Ground Water

Yet under the above conditions the highest rate of combined sewage and ground water flow reaching the disposal plant and measured over thin-edge weirs and for periods of eight hours was at a rate of 3,000,000 gallons in 24 hours. This rate for the maximum period of flow, according to excellent authorities, makes the approximate average flow in 24 hours at about 2,000,000 gallons, including sewage from 2,500 house connections, factories and infiltration from 32 miles of sanitary sewers. If we neglect the house connections, and assume the average house contains 4½ persons, using a per capita amount of 83 gallons per day, which is probably low, we arrive at the conclusion that the maximum infiltration is at most 1,066,250 gallons per day, or at a rate of 33,333 gallons per mile per day. The capacity of the sewers and of the pumps had been figured to receive 50,000 gallons per mile per day. When it is considered that in above estimate we neglect approximately 15 miles of house connections and that the sewers thruout were built in water-bearing material under present heads of 0 to 10 feet, excellent results from the construction are indicated. It may be of interest that the building of the sewers has resulted in drying up wells to a depth of 16 feet thruout the village, showing that the original intention of lowering the ground water table has been well accomplished. The original design of the sewers called for a future population of 25,000 using 83 gallons per capita, with ground water infiltration at the outset of 1,000,000 gallons per day. It is readily conceivable that the infiltration will decrease as time increases and the surface of the ground become more impervious. In regard to infiltration of sand, as has been questioned, we would state to date we have received no serious trouble whatsoever.

### Meeting Flood Conditions

The pumping station is 32 feet in diameter and about 27 feet in depth. The bottom is divided up into six compartments. In two of these there are two 1,050-gallons-per-minute, submerged, vertical, centrifugal pumps, with a 470-gallons-per-minute similar pump in a third compartment. The shafts pass upward with the runner supported on a ball-bearing step. This step is about 12 feet above the bottom of the pumps and 2 feet above the top of inlet sewer. At the time of the trouble one of the large pumps had been taken apart for an examination. About this time a thaw, accompanied with rain, caused the Tonawanda creek to overflow its banks and to cover certain outlying and low streets. Elsewhere certain streets were covered with storm water due to the inefficiency of the old storm water system. The result was that this water naturally ran thru the perforated manhole

tops of the sewers in several places. Certain cellars of houses along the shallow creek commenced to fill with water seeping thru the walls. The occupants opened up their cellar drains and sewers. From these various causes the pump well soon received all the water that the two pumps could handle. About this time a faulty ball-bearing on the second pump broke, leaving the small one to take care of the flow. Before the ball-bearing could be repaired the plant became flooded, forcing the machinists out of the well. The sewage being, to a certain extent, gritty, very soon got into the bearing of pump No. 3 and caused the bearings to break, thus forcing a complete stoppage of pumping. Within twenty-four hours a temporary steam-driven centrifugal pump of 1,050 gallons per minute was installed at a manhole outside of the pump station and one of the regular pumps was jacked up and run on split collars fastened on the pump shaft and resting on a journal box in the basement. Within forty minutes after these two pumps commenced to run the sewage was lowered and new balls inserted in the raceways of the bearings of pump No. 3. Then pump No. 2, which had been running on split collars resting on a journal box, was repaired. Within two hours the pump station was running the same as usual, the two pumps handling the entire flow. The fact that the creek had receded only a few feet, enough to prevent surface water from entering manhole tops, is indicative that the capacity of the pumping station is ample, excepting in an extreme case of the river flooding the low streets, as above.

K. B. MATHES,
Chairman Batavia (N. Y.) Sewer Commission.

ROBERT L. FOX,
City Engineer.

## Cost of Asphalt Repairs

The Editor of MUNICIPAL ENGINEERNG:

Sir—Your issue of February, page 127, contains an article on the "Inefficient Operation of Dayton's Asphalt Plant."

The facts, so far as given, may not show excellent results, but the deductions as to mismanagement seem to be equally open to criticism.

From the table, page 129, it is assumed that in the period of four years, 1908-9-10 and 11, 162,465.1 square yards of repairs were made. In 1908, there were 446,800 yards of asphalt pavement, 162,520 yards of which were under guaranty. To be liberal in estimate, it may be assumed that one-half of this pavement under guaranty came under maintenance in 1909, and all of it in 1910. Under this assumption there would have been 1,543,420 yard-years of maintenance, and, with 162,465 yards of repair, there was an average replacement or repair of 10.53 per cent per year. It is stated that in 1908 "most of the streets had been laid from twelve to fifteen years," but as over one-third the total area was then under guaranty, it may be assumed that the pavements had an average age of fifteen years during this period. This, then, would give an average annual repair rate of 10.53 per cent at 15 years' age. The rate in Buffalo, based on thirty times this experience, is an average annual replacement or repair of less than 4.5 per cent at 15 years of age, but with a cost of a little over $1.00 per yard of repairs.

The point of criticism noted is that which calls attention to the computed cost in 1910 as 49 cents per yard, while costs in 1908 were 88.3 cents and in 1911, 79 cents—"then it is evident that the plant was grossly mismanaged in 1908 and 1911."

This assumption that because repairs were made at 49 cents per yard one year, a rate of 79 cents another year represented "gross mismanagement" is, without detail of results accomplished, distinctly unwarranted. I should say in similar lack of details that any repairs made by cutting out and filling with new materials at 49 cents per yard was gross engineering malpractice. A yard of asphalt repairs is no more a definite commodity than a yard of cloth. It should be specified whether it is to be calico or velvet, and you cannot look for much wool, not to mention silk, in 49-cent asphalt repairs.

Possibly some resurfacing was done by this plant, in which case my comparison with Buffalo would not be applicable. In fact the meager data submitted are entirely insufficient to draw any conclusions or point any morals. Their publication is desirable that those interested may draw their own conclusions, but they are not sufficient to point a moral or adorn a tale. Their attempted use can only emphasize the danger of the present tendency to apply undigested figures to "efficiency engineering" and "scientific budget making" by the expert accountant rules, considering only quantity without quality and without full engineering analysis.

GEORGE H. HORTON,
Deputy Engineer Commissioner.
Buffalo, N. Y.

## Memphis Assesses Cost of Paving on Property

The city engineer of Memphis, Tenn., calls attention to the statement in the article on "Paving Conditions in Southern Cities," on p. 74 of the February number of MUUNICIPAL ENGINEERING, that

the principle of assessing the cost of street paving on the property benefitted now applies to Knoxville, Memphis and Nashville, as distinguished from the necessity of paying for all such improvements out of the general funds under former court decisions, and points out a difference in application of the principle in the cities mentioned, since Knoxville assesses but two-thirds of the cost on the property benefitted, as stated, while Memphis assesses the entire cost of the improvement upon the property benefitted.

## Binder Course for Bituminous Macadam Pavements

The Editor of MUNICIPAL ENGINEERING:

Sir—The Association for Standardizing Paving Specifications, at its fourth annual convention held at Pittsburgh, Pa., February 24 to 27, 1913, after careful consideration, unanimously determined that fine bituminous mixtures, like "Topeka" specifications, should be laid on a binder course in the same way as other sheet asphalt sand mixture surfaces.

The report of the committee of the above association on bituminous concrete paving specifications, which was unanimously adopted by the association, referring to such fine mixtures under the heading, "Binder Course," contains the following: "The binder course for macadam base shall be composed of a layer of clean, coarse stone of a size that will pass a 2 or 2½-inch ring and be retained on a 1-inch ring; it shall be evenly distributed over the surface of the macadam base described above and 1½ inches, or practically one stone deep, and rolled until the stones are practically level and forced partially into the macadam base. The rolling should be comparatively light, only enough to partially imbed the stone and set them firmly in place without crushing them or forcing the fine material up from below to completely fill the voids. This rolling should be done while the macadam base is still moist and comparatively soft. The stone of the binder course may be laid on without any coating or application whatever or, second, with an application of light bitumen after laying and rolling, or, third, coated with a bituminous cement before being laid. When a concrete base is used, the binder course shall be laid as called for under the standard specifications for sheet asphalt pavements."

The above association, in standardizing and insisting on the use of a binder course under all sheet asphalt surfaces, including the fine mixture asphaltic concrete or "Topeka" specifications, are acting in accordance with what actual practice has demonstrated to be the most standard forms of street pavement construction.

It has been my experience with the above type of wearing surface that creeping and shoving will take place even under moderate traffic unless a binder course is used. The binder not only prevents this displacement, but adds support and stability to the wearing surface, which, owing to its composition being mostly sand, does not have the traffic resisting qualities within itself.

The value of the binder course was brought out very clearly in a paper read before the American Society of Municipal Improvements at Dallas, Texas, by Mr. Isaac Van Trump, engineering chemist of Chicago, in which he says, in effect: "On streets where traffic is medium to heavy, sheet asphalt pavements or even the fine stone asphaltic concrete wearing surface now being laid in many localities, will frequently creep and shove alarmingly when laid without a binder course."

The committee appointed by the League of California Municipalities to make a study of the best practices in pavement and roadway building made an exhaustive study of the merits of the binder course and reported strongly in its favor for this type of wearing surface referred to, and so it seems to me that the practice of eliminating the binder course in asphaltic pavements in order to slightly reduce the first cost of the pavement, is one that is not in accordance with the best practices in street pavement construction.

F. N. BINGHAM,
Engineering Chemist, Portland, Ore.

## Graders for Road Work

The Editor of MUNICIPAL ENGINEERING:

Sir—The one most important township road-building implement is the grader, as its regular and proper use enables commissioners to not only make good highways at a reasonable cost but to maintain them and keep them in as good as new condition at a low expense.

The making and keeping of a proper crown is, as a rule, not given close consideration. After grading the road a long time the center of the highway may become too full. This condition has not been reached generally, but it may be. It is then time to turn the grader and throw the dirt from the center towards the edges.

A roadway well drained at the sides and treated with the grader consistently, faithfully and scientifically will never get very bad. It will be excellent to drive over eleven and one-half months of the year.

If all the money that is spent on the drag to the detriment of the road was put into grading there would be a great improvement in the highways. Because a township has many drags on hand is no

reason or excuse for using them to tear up and ruin roads.

A perfect dirt road can't be made with a grader in a day or a week, and scarcely in a year, but long and consistent use of it is bound to make a good road finally. The main trouble now with the grader is that it is used only spasmodically in many cases and then not at the right time.

We use traction reversible road machines very extensively in ditching, grading and trimming. These machines are operated by one man and are made by the Russell Grader Mfg. Co., of Minneapolis. We have been using horses for motive power thus far, but will undoubtedly operate traction engines this spring, as we expect to clear about ten miles of road and put in necessary ditches, bridges and culverts. The average grading will be in the neighborhood of twenty-eight feet thruout.

C. H. BORGSTROM,
Lima Township, Remer, Minn.

## Asphaltic or Bituminous Concrete Pavements

The Editor of MUNICIPAL ENGINEERING:

Sir—We are inclosing herewith a photograph of section of stone-filled bituminous or asphaltic wearing surface, cut from the concrete foundation on Greenfield avenue, in Milwaukee, and rubbed down on a marble rubbing bed, this pavement having been laid by the Socialist administration of Milwaukee in 1911. It shows very clearly the texture of the pavement surface.

To those who are rather familiar with the old type of 2-inch asphalt wearing surface laid on a 1-inch binder, it might be said in explanation that if the 25 per cent. or so of crushed stone were removed from the pavement shown in this picture and laid in a separate course under it as a binder course, you would then have the old standard type of binder and top wearing surface.

SECTION *of stone-filled asphaltic wearing surface.*

AMOUNT AND COST OF INGREDIENTS OF BITUMINOUS WEARING SURFACE MIXTURES.

| | Ashpaltic cement 1c per lb. | Stone dust 0 15c per lb. | Stone, ½ or 1″ 0 05c per lb. | Sand 0.028c per lb. | Total materials |
|---|---|---|---|---|---|
| Stone filled 2 in. thick, lb. per sq. yd..... | 18 | 22 | 50 | 110 | 200 |
| Cost cents per sq. yd..... | 18 | 3.3 | 2.5 | 3.1 | 26.9 |
| Bitulithic 2 in. thick, lb. per sq. yd..... | 15 | 10 | 125 | 50 | 200 |
| Cost cents per sq. yd..... | 15 | 1.5 | 6.25 | 1.4 | 24.15 |
| Straight sand 2 in. thick, lb. per sq. yd..... | 22 | 28 | none | 150 | 200 |
| Cost cents per sq. yd..... | 22 | 4.2 | none | 4.2 | 30.4 |
| Binder course 1 in. thick, lb. per sq. yd..... | 5 | none | 75 | none | 80 |
| Cost cents per sq. yd..... | 5 | none | 3.8 | none | 8.8 |

We are also inclosing a cost data sheet regarding asphalt and bituminous pavements on concrete foundation of various kinds.

The lowest bid that we received was from John W. Davitt, of Troy, N. Y., who has submitted a sample of Montezuma, Mexican asphalt, supplied by the Warner-Quinlan Co., who bid the following prices:

| | |
|---|---|
| 2-inch stone-filled sheet asphalt wearing surface, per square yard | $ .65 |
| 8-inch 1:3:6 Portland cement concrete foundation, per square yard. | .70 |
| 5-year guarantee bond, per square yard | .05 |
| Total for paving proper | $1.40 |
| Grading, average 8-inch sandy loam, per square yard | .16 |
| Granite curb, 6x12-inch, set in concrete and backed | .80 |

Needless to say, we intend to lay about 200,000 square yards of stone-filled asphalt wearing surface in spite of the injunction that has been issued against us to prevent our awarding the contract to the lowest bidder. We expect to receive even lower bids on April 2 for this work.

We are doing extensive sewer work; are about to reorganize and substantially reconstruct a very dilapidated water works system that supplies us with probably the best water any city can possibly have; besides which, we are engaged in city planning—about to build a public market, comfort stations and five model schools, and a garbage reduction plant.

C. A. MULLEN,
Superintendent of Public Works.

DETAILED COST OF ASPHALTIC PAVEMENTS OF VARIOUS MIXTURES.

| | Stone Filled | Bitulithic | Course Binder | Sand Straight |
|---|---|---|---|---|
| Materials for mixtures at plant, from above table | $0.269 | $0.2415 | $0.304 | $0.088 |
| Fuel at plant, per sq. yd. | .004 | .004 | .044 | .002 |
| Labor at plant, per sq. yd. | .04 | .04 | .04 | .02 |
| Repairs at plant, per sq. yd. | .005 | .005 | .005 | .003 |
| Tools and sundries at plant | .01 | .01 | .01 | .005 |
| Cost per sq yd. for mixture at plant | $0.328 | $0.3005 | $0.363 | $0.118 |
| Hauling from plant 1 mile to street | .021 | .021 | .021 | .01 |
| Labor laying and rolling | .05 | .05 | .05 | .03 |
| Asphalt cement for paving gutters | .001 | .001 | .001 | ..... |
| Tools and sundries on street | .01 | .01 | .01 | .005 |
| Cost of mixtures per sq. yd. laid on street | $0.41 | $0.3825 | $0.445 | $0.163 |
| Guarantee bond running 5 years, per sq. yd. | .05 | .05 | .05 | .01 |
| Supervision, management and office charges, per sq. yd. | .07 | .07 | .07 | .015 |
| Cost of wearing surface proper | $0.53 | $0.5025 | $0.565 | $0.188 |
| Binder course, per sq. yd. | ..... | ..... | .188 | ..... |
| Comparative cost of wearing surfaces, per sq. yd. | $0.53* | $0.5025* | $0.753† | ..... |
| Grading, per sq. yd. | .07§ | .07‡ | .075** | ..... |
| Concrete, per sq. yd. | .55†† | .55†† | .55†† | ..... |
| Total cost of pavement, complete, per sq. yd. | $1.15 | $1.1225 | $1.38 | ..... |
| Legitimate profit of 10 per cent. per sq. yd. | .11 | .11 | .11 | ..... |
| Reasonable bidding price for competing contractors | $1.26 | $1.23 | $1.52 | ..... |

*For 2-in. surface.
†For 2-in. surface and 1-in. binder.
§For 8-in. average grade.
‡For 2-in. average grade.
**For 9-in. average grade.
††For 6 inches of 1:3:6.

# ROADS AND PAVEMENTS

## Samples of Standard Pavements for Washington.

The many paving companies operating in the Northwest, and particularly in Washington, are building a road for the State of Washington.

By spring, the thorofare, which is going to form a link of over a mile in the International Highway, known as the Pacific Highway, should be completed and tho the paving companies are spending thousands of dollars to complete the road, all agree that it will not only advertise each company far in excess of their expectations, but that by giving this practical demonstration, their work will be subject to a fair and impartial inspection on the part of all municipalities or county boards of the state, contemplating using paving materials.

The idea first originated with the Olympia Chamber of Commerce, the organization of the capital city which sees that there is something doing all the time while the legislature is not in session, but so many requests have been received that the entire project has been practically turned over to the state highway department.

Secretary H. L. Whiting, of the Olympia Chamber of Commerce, wrote ten paving companies doing business in the Northwest, outlining the plan to them, which was as follows: The companies were each to construct a unit of paving, at least 100 feet long and 16 feet wide. Specifications are to be filed with the state highway department and the pavements are to be laid under its inspection; the highway commissioner, W. J. Roberts, in turn to keep the specifications, together with the reports of the inspectors, on file for the benefit of inquirers in years to come. Without a single exception the companies were enthusiastic over the plan and tho the frost is not entirely out of the ground several companies are now at work building their units.

The Chamber of Commerce of the capital city has written to every city council and board of county commissioners in the state, calling their attention to the construction of the highway and inviting them to inspect the different materials and pavements made with them. It is argued that the governing body of the city or county will be able to judge advisedly as to the merits of the different kinds of materials in use and will be able to adopt certain kinds for their cities or new districts to be improved.

In five years from this season, the "demonstration highway," as it is already known thruout the state, will be of more value from a test standpoint than it is today, when the paving is being laid just outside the city limits of Olympia, between the capital city and the suburb of Tumwater, where traffic is heavy.

Being on the Pacific Highway, which starts at Vancouver, B. C., and ends in Mexico, running the entire length of Washington, Oregon and California, the demonstration road will be traversed annually by thousands from all parts of the United States, and arrangements have been made with the abutting property owners for the different companies to erect signs opposite their units, calling attention to the portions constructed by them.

The State of Washington, unless vetoed by the governor, is going to spend approximately $8,000,000 for primary highways this year and the plan now contemplated is to hard surface the Pacific Highway from the Canadian line to the Columbia river.

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## Bituminous Surfaces on Brick Pavements

The city of Minneapolis, Minn., has been experimenting with bituminous surfaces on brick pavements with results which are quite interesting altho the first experimental pavement is not yet a year old.

The first of the accompanying photographs shows Nicollet avenue brick pavement, which, between Tenth and Thir-

NICOLLET AVENUE, *between Twelfth and Thirteenth Streets. Minneapolis. Old brick paving covered with asphalt in the spring of* 1912.

teenth streets, was laid in 1898 using a sand filler. It will be seen from the appearance of the bricks on the right half of the picture that the pavement shows little wear, except that the edges of the brick have chipped considerably. In a paper before the American Association for the Advancement of Science, Ellis R. Dutton, assistant city engineer, attributes this chipping to the use of power flushers for cleaning the streets, the sand joints being washed out, leaving the edges of the brick unsupported against the hammer of travel.

The improvements in the manufacture of asphalt fillers, so that the adhesion to brick surface is increased, at the same time that the melting point is kept high, led to the consideration of such asphalt, not only to fill the troublesome joints in the old pavement but to coat it, thus making the street less noisy and preventing further chipping. Half of the block of Nicollet avenue between Twelfth and Thirteenth streets was thus treated in the spring of 1912, and the appearance of the treated half is shown on the left in the photograph referred to. The surface and the joints were thoroly broomed and dried and the asphalt was then applied hot, about a half gallon per square yard. The asphalt surface received a thin coat of coarse sand.

The asphalt adheres to the brick very well in general, but has not adhered in some places, so that the appearance of the street is not all that could be desired. The coating does not become excessively soft under a hot sun, is not brittle from cold, reduces the noise, and increases the foothold for horses.

The asphalt used in this experiment was rather low in melting point and penetration, as may be seen from the first column of the accompanying table, prepared from data given in Mr. Dutton's paper, above referred to.

### Bituminous Coat on New Pavements

Bituminous fillers have been used for brick pavements constructed in Minneapolis since 1906, and pavements in which they are used are cleaned with the power flushers without injury. The apparent success in surfacing the old brick pavement with the thin asphaltic coating last spring suggested the same treatment for new brick pavements, so about double the amount of asphaltic filler usually required was applied, about 10 pounds per square yard, and the filler was spread over the surface as well as run into the joints. The labor cost was enough less than that required for the old method of filling joints only, so that it offset the increased cost of asphalt, keeping the total cost of the pavement the same as under the old specification. About 38,000 square yards of new brick paving have received this treatment during the past season. The

second of the accompanying photographs shows Marshall street and Thirtieth avenue, N. E., a new brick street in process of filling and coating.

are made promptly. As in any bituminous work the surface must be thoroly clean and thoroly dry and the work must be thoroly done.

MARSHALL STREET AND THIRTIETH *Avenue. Northeast, Minneapolis. New brick paving filled and coated with asphalt in* 1912

The asphalt used was somewhat heavier than that on Nicollet avenue as will be seen from comparison of the analyses of the two given in the accompanying table.

ANALYSES OF ASPHALTS USED IN COATING MINNEAPOLIS BRICK PAVEMENTS.

| | Old brick, Nicollet Ave. | New brick, 30th St. |
|---|---|---|
| Specific gravity, 77 deg. F. | 0.980 | 0.9885 |
| Melting point, Am. Soc. C. E., deg. F. | 117 | .... |
| Melting point, ball and ring, deg. F. | ... | 180 |
| Melting point, Gen. Elec., deg. F. | ... | 183 |
| Penetration, 32 deg. F. | 60 | 46 |
| Penetration, 77 deg. F. | 175 | 67 |
| Penetration, 77 after heating | ... | 58 |
| Penetration, 115 deg. F. | ... | 122 |
| Flash, deg. F. | ... | 536 |
| Burn, deg. F. | ... | 580 |
| Loss, 5 hrs., 325 deg. F., per ct. | 2.4 | 0.04 |
| Soluble in carb. di-sulph., per ct. | 99.7 | .... |
| Soluble in 88 deg. B. naphtha, per cent | 75.5 | .... |
| Soluble in carb. tetrachl. per ct. | ... | 99.6 |
| Organic matter insoluble, per ct. | 0.2 | .... |
| Ash, per cent | 0.1 | .... |
| Fixed carbon, per cent | 7.8 | 11.62 |

Mr. Dutton thinks that the quality of bituminous material for this use could be improved by manufacturing it expressly for such duty so as to produce a maximum of adhesive strength without unduly increasing brittleness in cold weather or the tendency to soften under a hot sun. The bituminous surface will wear off but it can be renewed for a small cost per square yard and the bricks themselves are protected from wear if such renewals

## Road Building in Oregon

*By Helmus W. Thompson, County Judge, Eugene, Ore.*

An interesting experiment in the dissemination of good roads ideas is being tried at Eugene in Lane County, Oregon. In Oregon the unit of road administration is the county, which is divided by the County Court into road districts, in each of which the Court appoints a road supervisor. The road supervisors are under the control of the Court and may be discharged for disobedience. The officers having road matters in charge are the County Judge and two County Commissioners. It seemed to these officials that it would be a good plan to spread more widely the instruction afforded by the Federal Office of Public Roads. Thru the courtesy of this department and Mr. Logan Waller Page, its very efficient director, there were sent to the County Court five road models; one of a dirt road, one of a gravel road, one of a water bound macadam road, one of a bituminous macadam road, and one illustrating drainage. These models are three feet by five feet, and are the same as the ones included in the United States exhibit at various expositions. Every road supervisor gets into the Court House a number of times during the year and fully one-half the ranchers of the county come to the Court House during the year. It is impossible for them to come into the County Court

House without noticing the models, and the County Court explains the models to them and tries to impress them with the correct principles of road building.

We have only had them for two months, but I have no hesitation in saying that the scheme is successful and that it could be used with advantage thruout the country.

In addition to the road models the Court has models of the Little Western graders used by the county and sample of the American ingot iron metallic and concrete culverts used.

Recently a convention of road supervisors was held in Eugene and these models were of great benefit in instructing the supervisors and many others who were present.

Lane County will be crossed by the Pacific Highway and this county has already 16 miles, more than a quarter of the distance, laid in water bound macadam or better, and further work will be pushed during the coming season. In addition to this macadamizing work there have been laid on the highways of Lane County 52,000 yards of crushed rock and gravel in the past year.

Early in the past year the County Court adopted the policy of building well a few miles of road each year. Repairs are made every summer by the different road districts. The County Court employed a competent road supervisor to have general oversight over all road construction in the county, advising the district road supervisors, and recommending to the County Court the improvements that he deemed necessary. More particularly, however, the superintendent has charge of macadamizing work, of which seven miles were completed last year in sections adjacent to each of the larger cities.

The county has purchased modern equipment, including a score or more of road graders, auto trucks for hauling crushed rock, rock crushers and heavy road rollers. The graders are sent to the various districts where there may be demand for them, but the heavier machinery is used for the greater part in the macadamizing operations.

Something new in road work this winter was the employing of men to patrol a section of stage road in the western part of the county. These men are to go over certain sections of the road constantly, remove rocks, drain mud holes, and in other ways keep the roadway in repair. If the results in easier winter travel and in preservation of the roadbed justify, the patrol system will be extended, or at least for the winter months, when Oregon rains usually do the most damage to the roads.

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## How to Repair Asphalt Pavements

*By W. L. Hempelmann, Engineer Bituminous Roadways, St. Louis Street Department; Member Illinois Society of Engineers*

Everyone interested in the maintenance of bituminous pavements is familiar with the asphalt patching gang, the necessary equipment and the manner in which repairs are made. "Cutting out and plugging in," as the most common means of repairing an asphalt or bitulithic pavement is termed, is most generally used. To do this properly and satisfactorily requires more attention to details than the casual observer would believe. Trimming the joint, properly painting same, tamping or rolling the hot asphaltic top mixture of the desired consistency into the prepared depression, is the general procedure. The accompanying photograph shows the process, except that the roller is absent. A careful examination of such a pavement where patching, as described, has been done, will frequently reveal the fact that the joint between the patch and

MACADAM ROAD NEAR EUGENE ORE., *part of Pacific Highway.*

the old pavement has not been sealed, due perhaps to what is known as a "dirty joint," but generally to carelessness on the part of the laborer in not painting every part of the exposed edge of the depression. This condition is easily observed when, after a rain, the sun has dried up the surface of the pavement, while the patches are definitely outlined by a wet line. Another source of trouble comes from the pushing or displacement of patches because of the material used. The patching material should be as nearly as possible of the same consistency as the old pavement, that when the summer's sun warms up the pavement, the old and the new material may soften to the same degree. The folly of using a new street mix as patching material in an old pavement has frequently been exemplified.

ASPHALT REPAIR GANG *at work on a St. Louis street.*

### Surface Heater

A temperature variation from five or ten degrees below zero to 120 or 130 degrees Fahrenheit in the summer's sun, on the surface of the pavement, presents a complex problem concerning the proper mixture to be used. Under slow moving heavy loads in the summer, the material is apt to push or creep, bringing about a wavy or undulating condition of the surface. Such a pavement is very "bumpy" to the automobilist. This condition can frequently be remedied by the use of surface heaters. By this means, the bumps or high places are softened and all the burned and soft material is scraped off, leaving a clean surface of the old material. Such burning should be continued until the burned area will require at least one inch of added material to restore the pavement to its proper surface and cross-section. In almost every case, it is well to cut a joint at the edge of the burned area, an inch or an inch and a half deep, that the edge of the old pavement may serve as a shoulder for the new material. The surface of such burned area should be made as rough as possible, using a pick or the point of a hoe, that the old material may serve as a key to hold mechanically the new material in place. The whole area should be liberally sprayed or sprinkled with an adhesive asphaltic cement, to bring about a better union between the old surface and the new material. This method is economical and when properly done, gives entire satisfaction. Our records show that this method of making repairs, including labor, material, roller and fuel, costs from fifty cents to fifty-five cents per square yard, depending upon conditions, while straight patching in the ordinary way costs from seventy-five cents to ninety-five cents per square yard.

### Joints Must Be Waterproof

Here, again, it is absolutely necessary that the joint between the old and the new pavement be waterproof for the best results. The effect of an imperfect joint or not properly sealed joint is best seen in the late fall or early spring of each year, when, by alternately freezing and thawing, the moisture in the joint tends to separate the patch entirely from the rest of the pavement. Such a joint, once opened up during the winter, will not heal in the summer under traffic, the dust from the surface finding its way into these small crevices and preventing for all time the amalgamation of the two mixtures.

In the case of larger stone mixtures, it is this open surface condition, which permits moisture to freeze and thaw in the surface, that materially aids in pitting of the surface. Steel tire traffic on such a wet, open surface is much more detrimental, in that the steel grinds or crushes the surface rock much more readily because of the better "grip" it gets on

same. In the case of mixed traffic, motor and steel tired, the suction, created by the rapid motion of the former, tends to redistribute these fine particles. This can be seen when, after a heavy shower, the fine material from the surface can be found at the low point in the grade.

### Waterproofing the Surface

Recognizing water as one of the worst enemies to smooth pavements, we have endeavored to waterproof our asphalt and bitulithic pavements by treating the surface. Flush-coating or squeegee-coating the last-named pavements has generally been done, as a matter of course, to "seal the surface." Hand squeegee carts or pressure wagons to evenly distribute the bituminous material with a coating of sand are generally used. In recent years, the economy of flush-coating the bitulithic streets under contract maintenance is evidenced by the fact that a flush-coat gang is one of the regularly equipped maintenance gangs when repairs are begun after the winter. This thin coat on the surface performs a double duty. It tends to waterproof the surface, by filling all the surface voids, and with the sand, forms a thin cushion coat on the surface, taking the wear off the pavement proper. In other words, we tend to build up the pavement by the judicious application of flush coats, rather than permit the pavement to wear down under traffic. Under our traffic conditions, such a flush coat wears at least a year. Using tar at 7¼ cents per gallon and applying same by means of pressure wagons, our total flush-coat cost on bitulithic pavements this summer, including tar, sand, teams and labor, was about 2½ cents per square yard.

In the case of asphalt pavements, we applied the same reasoning. We have oiled some of our asphalt pavements and covered same with sand at a cost of about one cent per square yard, for material, covering and applying. An old pavement in this case, it was thought that the oil treatment would help keep the water out of the pavement and, at the same time, tend to give new life to the bitumen in the pavement. This thin cushion coat on the surface plays an important part in the wearing of such pavement during the winter months, when chains are attached to the driving wheels of the automobile, the pounding having the same effect as so many trip-hammers passing over the pavement. This thin layer on the surface largely takes care of this added wear.

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## Bituminous Surfaces for Roads

Bituminous surfaces for roads are neatly classified by Arthur W. Dean, the Chief Engineer of the Massachusetts Highway Commission, in a paper before the American Association for the Advancement of Science. The treatment of a road surface with an oil emulsion serves as a dust layer and does not form a distinctive part of the wearing surface of a road. A bituminous surface of appreciable thickness may be formed on top of a road crust by the application of one or more coats of bituminous material, with gravel, sand, or stone chips added. This is called a bituminous carpet surface. If the bituminous surface approximates 2 inches in thickness it can no longer be termed a carpet, but rather becomes an integral part of the road crust or pavement.

### Oiled Macadam

The first class is hardly a bituminous surface, for it is produced by adding a small amount of light oil to the road dust to prevent its removal by the wind and by traffic. This serves the same purpose as sprinkling with water, but is better, because the physical characteristics of the oil cause it to do the work required better and to retain its effect longer. This oiling does not improve the wearing qualities of the road very much beyond the effect of retaining the material on the road surface and thus covering the road material below. Heavy oiling and addition of dust and sand may make this class of road surface approach the second class, which Mr. Dean terms the bituminous carpet. The first class is a cheap treatment suitable only for light travel and for temporary purposes and requires frequent renewal.

### Bituminous Concrete

The third class includes the best grades of bituminous surfaces, beginning even with asphalt and bitulithic pavements and continuing down thru the various forms of bituminous concrete and bituminous macadam, produced by mixing the road materials with the bitumen before laying, and, perhaps, some of the best road surfaces produced by the penetration method. Such road surfaces are expensive and can usually be afforded only on the roads of heaviest traffic in the vicinity of large cities where property valuations are high enough to raise the necessary money without making the tax rate excessive.

### Bituminous Carpet

The second class, Mr. Dean's bituminous carpet, is of the most general application to country roads, being in some form or other of sufficient stability to keep its place under the traffic to which it is subjected, and low enough in cost to be within the means of the districts in which a surface of this class is desirable and economical of maintenance. The quality of the surface may vary from something not much better than the best

oiled surface, tho only the heavier asphaltic oils are used, almost up to pavements suitable to city streets.

### Good Foundations Necessary

The first requirement is a good foundation, something which is likely to be neglected in this country. Many bituminous carpet surfaces which have failed would have been successful and economical if the foundation had been sufficient. The road crust or carpet cannot sustain any load if there is a failure below and in such cases is immediately cut to pieces. For average traffic on suburban roads Mr. Dean considers a water-bound macadam road on a suitable and sufficient foundation as an ideal crust on which to apply a bituminous carpet. With heavier traffic or treacherous foundations a cement concrete crust will be even better, but a carpet of asphaltic nature will not adhere to it as one in which tar is used. A good gravel road will serve for light traffic, but does not hold a carpet made with heavy asphaltic or tar binders unless the carpet approaches the third class in thickness. The bituminous binder used should not require heating beyond 100 deg. F. before application, as distinguished from heavy binders requiring heating to 180

PRESSURE DISTRIBUTER *of tar for bituminous carpet.*

deg. F. or more. A dirt road cannot be used as the base of a bituminous carpet, as it breaks up under any kind of traffic.

### Laying the Carpet

The carpet must be uniform in thickness, the grit being spread uniformly and the tar applied under pressure, so that it will also be spread uniformly and will penetrate thoroly. The best results are obtained by using, first, coarse material, consisting of tough pebbles or stone broken approximately to half-inch diameter, followed immediately by finer material, such as sand or a coarse grade of stone dust. This produces a good mixture of the two materials and gives better results than either the fine or the coarse material alone, especially if there is much hard-tire traffic. Assuming a half-gallon of tar to be required per square yard, more uniformity is obtained if it is applied in two coats of a quarter-gallon each, each layer of bitumen being covered with grit immediately after application. The grit should be clean—no clay or loam.

Under mixed traffic—trucks, automobiles, heavy and light horse-drawn vehicles—the asphalts requiring temperature of 200 deg. F. or more to melt into condition for application give better results than lighter bitumens, according to Mr. Dean. But if the traffic is largely heavy steel-tired vehicles, the lighter bitumens give better results, the tendency of the heavily loaded tires being to cut the carpet and cause it to crumble if the asphalt is not flexible.

### How to Choose the Right Method

The character of traffic has everything to do with the choice of the kind of road surface and Mr. Dean is quite as strong an advocate of the traffic census and comparison of road conditions as are the editor of MUNICIPAL ENGINEERING and nearly all prominent road engineers. Mr. Dean gives, in the paper above referred to, some examples of the action of traffic on roads which warrant this stand. He says:

"It has been demonstrated that a tar carpet will carry economically 100 automobiles per day per foot in width of roadway, together with a horse-drawn traffic of 15 vehicles per day per foot in width of roadway. On the other hand, a similar tar carpet failed under a traffic consisting of 20 heavy horse-drawn, steel-tired vehicles per foot in width of roadway per day, with only 8 automobiles per foot. This clearly demonstrates that a tar blanket is not suitable and should never be used to sustain heavy horse-drawn traffic, but is suitable and economical in carrying automobile traffic. Inasmuch as no particular wear appeared to be caused by the above mentioned automobile traffic, it is safe to assume that a much larger traffic could be economically carried. Records kept by the writer show that what has been stated above regarding the tar carpet is true also of the heavy asphaltic oil carpet. Failures that have occurred under the writer's observation with a heavy asphaltic oil carpet have occurred where the ratio of the number of automobiles to the number of horse-drawn vehicles was not any greater than two to one, and if the horse-drawn vehicles are of the heavy two-horse type, with narrow tires, no amount of automobile traffic appears to be sufficient to counterbalance the destructive effect of 15 heavy horse-drawn vehicles per foot in width per day.

Mr. Dean is of the opinion that it is not wise at the present time to state general positive conclusions regarding limitations in the use of bituminous carpet surfaces. Such surfaces have been in use in this country only about four years, and the character and quality of the bitumen used at various times and in various places are so unequal, and the character of traffic over the highways is and has been changing so rapidly, that the results of experiments and observations have been variable. Positive and definite conclusions as to limitations can only be drawn after careful observation through a period of years, keeping a record of the kind and quality and amounts of material used in the carpet, and of the kinds, number and approximate weights of vehicles passing over the sections under observation.

### Asphalt Must Be Tough

The toughness of the bituminous material to be used in treating road surfaces has been studied by J. E. Myers, the chemist of the New York State Department of Highways, and he presented some of his results in a paper before the A. A. A. S., at its recent convention.

He says that in 1909 about 200 miles of asphalt-bound macadam were constructed, using asphalt with penetration 225, and there was much complaint of "bleeding" the next summer, requiring additional grit on the surface, which did not always consolidate with the old surface, and became loose, wavy and easily rutted.

In 1910 the penetration requirement was reduced to 120 and the quantity used was slightly reduced. Some of the 435 miles of these roads raveled badly or broke up in the following winter. Examination showed that the asphalts all had about the same chemical qualities, but those used in roads which were in good condition were less susceptible to the weather, more tough, less brittle, than those used in the roads which raveled.

A test for toughness was then devised, dropping a weight on a ball of the asphalt at 32 deg. F. temperature, the measure of toughness being the drop in millimeters necessary to rupture the ball, the test being that of the American Society for Testing Materials for toughness of macadam stone, with the addition noted above.

In 1911 the penetration of the asphalt was increased to 160 and a toughness of at least 15 was secured. Of the 500 miles laid that year, there were no failures from brittleness of asphalt. The same is true of 1912.

The conclusions reached at this time are that any binder with toughness at 32 deg. F. less than 15 is not safe, especially for the penetration method; that toughness of 15 to 25 does not give a large factor of safety, but will not give trouble unless the roads are built late in the fall and not consolidated before freezing weather begins; and that asphalt of toughness of 25 or more will not give trouble from brittleness under any ordinary conditions.

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## Improvements in St. Joseph, Mo.

*By Charles W. Campbell, City Engineer.*

More than five miles of paving was laid in St. Joseph during 1912, including streets and alleys, at a total cost of $151,543.52. This paving was done at a smaller cost than was paid for only four miles laid in 1911, the tax bills for that year's work having totaled $152,342.28. Thirty-four paving contracts were completed within 1912; work on six is in progress at this time; proposals have just been received for seven jobs; eight are ready to be advertised; five are pending in the council; fifteen are in course of preparation in the engineering department, and nine jobs are before the board of public works.

Almost three and one-half miles of grading was done in 1912, at a total cost of $16,418.15. Twenty grading jobs were completed; two are in progress; four are ready for advertising; thirty-three are in preparation in the engineering department; eleven are pending in the city council; fourteen are in legal progress; five are tied up in the city treasurer's office, and one is before the board of public works.

Eight sidewalk jobs were completed within the last year, at a cost of $11,962.74. Only six jobs were done during the preceding year, at a cost of $870.70. Bids recently were received on two sidewalk jobs; ten propositions are in the engineering department; one is before the council, and two are before the board of public works. The sidewalk record is considered an unusually good one, and the year's work marked the inauguration of a campaign for artificial stone walks on all the principal streets of the city. Almost two miles of concrete walks were laid on Ashland avenue last year.

Practically four and one-half miles of district sewers were constructed during 1912, costing $33,081.72. Thirty-four sewers were completed; seven are building; bids on seven sewers have just been received; eleven are ready for bids; twelve are in the engineering department, and four are pending in the council.

Four main sewers were built at a cost of $33,000, and three are in course of construction. A proposition for another extention of Blacksnake main sewer from Wallace street to New Ulm Park has been started.

The total amount expended for im-

provements completed during 1912 was $246,006.13 for 100 jobs.

The street department expended $18,784.38 as follows:

| | |
|---|---|
| Flushing streets | $3,014.62 |
| Sweeping streets | 6,633.75 |
| Work on dirt streets | 7,293.19 |
| Cleaning gutters | 1,842.62 |

Extra work done during 1912 included the following improvements, with cost of each:

| | |
|---|---|
| Stairway at Fleeman street | $210.00 |
| Brown's Branch ditch | 715.77 |
| Huntoon street bridge | 445.00 |
| Bridge at 3rd and Valley streets | 367.00 |
| Bridge at 2d and Atchison sts | 385.00 |
| Hose house No. 1, Fourth street near Charles | 8,668.90 |
| Hose house No. 16, 33d street and Mitchell avenue | 5,617.35 |
| Hose house No. 15, 4th and Sycamore | 5,519.10 |
| Repairs to paved streets | 4,757.31 |

## Motor Traffic Requires Heavier Foundations in London Boroughs

The Metropolitan Committee on the Materials and Means of Paving the Streets of London received a number of replies in response to an inquiry whether motor traffic has had the effect of increasing the cost of paving and maintenance. In most cases the answer is in the affirmative. Many surveyors report that they are finding it necessary to increase the depth of the concrete foundations. In Bermondsey, for instance, while concrete 6 inches deep was formerly sufficient, the depth is now being made 9 inches or even 12 inches. In Hackney foundations which were sufficient a few years ago are now found quite inadequate and in new work the concrete is being made 50 per cent. thicker. The Hampstead surveyor considers that the life of wood paving has undoubtedly been reduced by one or two years, and it has become necessary to increase the thickness of the concrete foundations from 6 inches to 9 inches. In Holborn cement foundations 12 inches thick are being laid in places where a thickness of 6 inches was sufficient ten years ago. In Paddington concrete from 10 inches to 13 inches thick is being used on wood-paved carriage ways where the thickness was originally about 7 inches, and in Westminster the specification now used when new foundations have to be laid provides for 1 inch of floating and 8 inches of concrete foundation instead of 6 inches.

On the other hand, the Fulham surveyor states that motor traffic has had the effect, if anything, of decreasing the cost of maintaining wood-paved roads. It soon finds out weak spots and the immediate repair of these appears to increase the

STATE STREET, *Sycamore, Ill.*

## A Handsome Street in Sycamore, Illinois

What can be done with the main street in a small city is well shown in the accompanying photograph, for which we are indebted to Mayor J. D. Beckler.

State street, the main business street of Sycamore, Ill., is 100 feet wide, with 12-foot cement walks and an asphalt pavement 76 feet in width. There are 38 of the ornamental street lighting posts, spaced about 60 feet apart, 28 with 3 lights each, and 10 with 5 lights on the street corners. The columns are Pettyjohn reinforced concrete posts and the lights are 60-watt 110-volt Mazda. The concrete foundations of the posts are 24 inches square and 24 inches deep and they are connected by an underground simplex lead-encased steel-taped cable.

number of repairs; but the life of the wood-paving is considerably increased and more than compensates for the increased cost of repair. Scavenging also has been considerably reduced. On water-bound macadam roads in Fulham motor traffic has caused considerable damage and disintegrated the surface, but the roads so affected have been remade with bituminous macadam, with the result that the cost of maintenance of such treated roads now submitted to motor traffic is not more, perhaps less, than of the water-bound surface before motor traffic came upon it. In Finsbury the surveyor cannot say that motor traffic has increased the cost of road maintenance, and in Westminster, while the engineer is of the opinion that the increase of motor traffic prejudicially affects macadam roads and, perhaps to some slight extent, asphalt roads also, he does not think that, as a result of motor traffic, there has been any increase in the cost of maintaining paved roads originally laid on present approved methods. The Hammersmith surveyor considers that on wood-paved roads time will show decreased cost of maintenance, since the life of the wood will be slightly lengthened, but on all other roads the expense is largely increased.

## The Movement for a Traffic Census on Roads

Recognizing the fact that more information is needed in determining the proper type of construction for any given section of road, the National Good Roads Board of the American Automobile Association is convinced that proper steps should be taken in every state in the Union to gather such data as will show the number, character and approximate weights of vehicles passing over the principal roads.

The failure of many roads to stand up under the traffic is due, not as many persons suppose, to inferior materials and workmanship, but to the lack of preliminary information as to the traffic the road was expected to stand. Consequently, roads have been built which would have lasted for years under other travel conditions; now they are ruins, due to the absence of data which the engineering profession in any other branch of their work would have considered essential. On this subject an authority says:

"Without knowing the wear a road has, there is absolutely no way of telling whether it is good or bad; only a careful traffic census can determine this. Roads too costly have been constructed in some places; in other places roads unsuited to the traffic have been built. In view of this well-known fact, it is evident that a traffic census is an essential to economy in nearly all road building. Imagine a bridge designer making plans for a structure without anything more than a rough guess whether it was to be used by steam railways or trolley cars, and we have an idea of the absurdity of proceeding with road building without traffic data."

Illinois, in 1907, caused to be enumerated the travel over the roads at a few important points, and in March, 1913, Highway Engineer Johnson writes: "I am sure we never collected any data on which I feel that I can place greater reliability than our traffic census data. It has been, all things considered, the most satisfactory investigation that we have attempted."

Massachusetts tried taking a traffic census in 1909, and went into the subject on a larger scale in 1912. In August and October, 1912, counts were made at 160 stations at different points in the state, each covering a full week of time, and twelve to eighteen hours a day, according to location. The results enable the Highway Commission to make plans for not only carrying the present travel, but also to provide for the increase that is bound to come.

It is considered, in view of the rapid changes in traffic and traffic conditions being rapidly and constantly made, that traffic census should be provided at least four times a year, of at least a week at each period, and should cover the principal roads entering every city in a state. To be of real value, the census should continue for a series of years, in order to establish a proper knowledge of the ratio of increase. After a few years, and the establishment of practical standards from which estimates could be made, so great frequency of count would not be necessary.

Provisions for traffic census in most states will require the enactment of special laws, and special appropriations. Compared with the saving which would be effected in road construction the expense would be trivial. The figures, when made and properly collated, would be the basis on which all highway planning would rest.

## Sanding Wooden Block Streets

*By W. L. Hempelmann, Street Department, St. Louis, Mo.*

It has been the practice in St. Louis for the last three years to oil and sand the wood-block thorofares. This, largely, is a treatment for slipperiness, and was evolved gradually. Sand or sharp grit was first spread over the surface of such pavements.

Most of the sand was soon found in the gutters, blown to the side by the rapidly-

moving motor cars and by the wind. The benefit from such a treatment was very short lived. Next, oiled-sand was tried, the oil and sand being mixed in asphalt mixing pans and spread over the surface from wagons. This was slow, expensive and unsatisfactory, since the sand had to be heated and dried to mix the oil with same, and when this warm material was hauled to the street, the bottom of the load was extremely soggy because of the oil which percolated from particle to particle of sand and collected near the bottom. Spreading this soggy material uniformly was impossible. Then, at the suggestion of Mr. J .C. Travilla, Street Commissioner, the oil was sprayed on the

SPRAYING OIL *on wood block pavement, to be covered with sand.*

wood-block surface and covered with sand. This method proved very satisfactory and was economical, costing about one cent per square yard for oil, sand and labor. For this work we apply about one-eighth of a gallon per square yard, using a pressure wagon for distribution. Such a treatment lasts through the winter and largely helps to waterproof the surface. The accompanying photograph shows the oil sprayer at work.

## Creosoted Wood Block Pavement in the Boroughs of the Bronx and Brooklyn, City of New York

"Our present practice is to lay long leaf yellow pine block only on those streets carrying the heaviest traffic," states Thomas W. Whittle, commissioner of public works, Borough of the Bronx, city of New York.

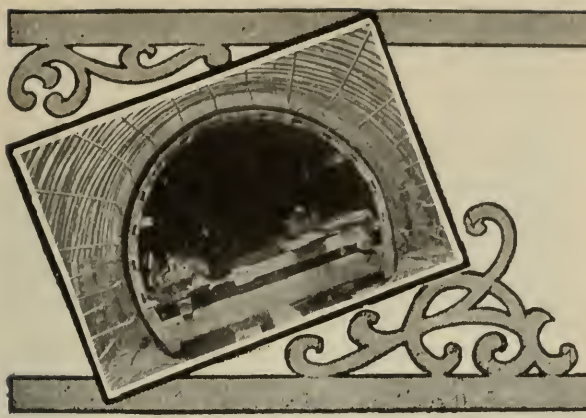
"There are plenty of pavements which are not good for heavy traffic streets, but we know creosoted wood block is and the heavier it is founded the better it wears and endures. The conditions of streets paved with wood block, as compared with other streets paved at the same time with the other types of pavement, are very favorable to the wood blocks. Aside from noiselessness of traffic, I should say that other advantages are that the pavement is sanitary, easily repaired and cleaned. With one exception the pavements thus far laid are still under guarantee. The exception referred to is Tinton avenue, where the upkeep cost for 1910 was 8 cents per square yard, and for 1911 9.1 cents per square yard.

"Blocks are laid with grain vertical. The cleaning of the streets comes under the jurisdiction of the street cleaning department. The work is done by sweeping and, under certain conditions, flushing.

"Creosoted wood block is laid in the following streets of this borough:

| Name of street | Length paved feet | Sq. yds. | Date of completion |
|---|---|---|---|
| Brook avenue | 548 | 5,170 | 12/26/07 |
| Charlotte street | 1,080 | 3,644 | 12/14/08 |
| Lyman Place | 542 | 1,785 | 11/16/08 |
| Minford Place | 1,349 | 4,541 | 11/16/08 |
| Rogers Place | 901 | 2,975 | 12/24/08 |
| Southern boulevard | 8,794 | 70,338 | 4/13/08 |
| Southern boulevard | 900 | 5,987 | 8/25/11 |
| Suburban Place | 281 | 917 | 11/10/08 |
| Tinton avenue | 2,415 | 8,102 | 8/ 4/04 |
| E. 136th street | 493 | 1,710 | 12/13/08 |
| E. 154th street | 171 | 455 | 12/ 7/08 |
| Webster avenue | 805 | 5,562 | 5/25/12 |
| E. 158th street | 244 | 655 | 4/27/12 |

"We use long leaf yellow pine creosoted wood blocks very extensively in this borough," states H. H. Schmidt, chief engineer, Borough of Brooklyn, city of New York. "This pavement is subjected to all kinds of traffic and we believe the maintenance cost is very low, everything considered. The maintenance cost of a pavement is a very important item. The first cost is undoubtedly less important than the upkeep and maintenance cost.



# SANITATION

## Sewage Disposal and Water Supply at Duluth, Minn.

*By John Wilson, City Engineer, Member Minnesota Engineers' Society.*

DULUTH discharges its sewage into Lake Superior, the largest body of fresh water in the world, and the source from which it takes its water supply, and it still has water of good quality.

The shore line of this city is about fifteen miles long, very steep and rugged, making the run-off very rapid and complete. The average temperature of Lake Superior being lower than that of Lake Michigan, disposal of sewage by dilution is more favorable than at Chicago, where the amount of dissolved oxygen in the water will necessarily be less. While conditions are very favorable for this form of disposal in Duluth, they are very unfavorable for artificial methods of treatment. During rainstorms the whole shore line is more or less polluted by the washings from barnyards, street gutters, storm sewers, cesspools, etc. A great deal of storm water is admitted to the sanitary sewers, which only tends to increase the difficulty of treatment. Then the difficulty of picking up all the various outlets along the shore, or of installing individual plants at each outlet would be considerable.

### Septic Tanks Not Applicable

Septic tanks would be entirely out of the question, as each would tend to increase rather than diminish the nuisance at the various points, and as far as improving the bacteriological condition of the lake, the change could probably not be detected.

The most favorable method of treatment would no doubt be by the installation of Imhoff tanks, followed by calcium hypochlorite. The first cost of such a scheme would possibly be about $300,000, with an annual cost about as follows:

| | |
|---|---|
| Payment into sinking fund to redeem bonds in 20 years, interest at 4 per cent | $10,074.00 |
| Interest on first coat at 4 per cent. | 12,000.00 |
| Chemicals at 1½ cents per pound. | 6,750.00 |
| Labor and maintenance | 10,000.00 |
| Total | $38,824.00 |

This treatment might result in a removal of about 96 per cent. of the organisms, but there might still remain a "resisting minority" of about 150,000,000 in every gallon of the effluent. In time of storm, however, we could not expect to secure results as good as this. In addition, the pollution from the street wash, cesspools, barnyards, etc., would still give us quite a problem to deal with, and the protection offered by the sewage purification plants at such times would not be very great. Then, too, calcium hypochlorite, like all other forms of disinfectants, has its selective peculiarities, and it is quite possible that a great many of the organisms destroyed by its use are soon killed off, anyway, by natural causes shortly after reaching the lake water. It is quite evident that while we have accomplished considerable, as far as the sewer goes, very little has been accomplished as far as protecting the water supply is concerned.

### Water Supply Purification Effective

Duluth's intake is several miles from where the greater portion of the sewage is discharged, and rarely is there any suspended matter in the water. The bacteriological count is very low, rarely exceeding, I am told, 25 per cubic centimeter. But colon bacilli have been found quite frequently in 100 c. c. amounts, and the water is now being treated with calcium hypochlorite at the rate of 0.13 part per million available chlorine. And this very small quantity removes about 75 per cent. of the organisms, leaving an average count of about 5 per c. c., and colon bacilli seldom present in 100 c. c. amounts.

The cost of the treatment is, of course, practically nothing, and consumers cannot detect the presence of the chemical.

If, in the near future, the increase in the pollution from all sources should be such that the above treatment would seem not sufficient to safeguard the city against infection, and it should be advisable to in-

stall a filter for the water, the first cost would possibly be about $300,000, with an annual cost as follows:

| | |
|---|---|
| Payment into sinking fund to redeem bonds in 20 years, interest at 4 per cent | $10,074.00 |
| Interest on first cost | 12,000.00 |
| Cost of chemicals | 150.00 |
| Operation | 6,000.00 |
| Total | $28,224.00 |

More than $10,000 per year less than that of treating the sewage, and with results that will not admit of comparison.

Duluth's attitude in this matter at present is the right one, the water is being treated as the amount of pollution demands; and as the city grows in the vicinity of the pumping station, care must be exercised that sewer outlets do not encroach on the intake. In the course of time conditions may arise, most probably along the bay, when it will be necessary to treat the sewage for the purpose of preventing a local nuisance. But not unless the science of sewage purification is wonderfully advanced over what it is today will it be for the purpose of protecting the water supply. The Royal Commission has but recently advised a repeal of England's present laws, and the adoption of standards for sewage purification more in accordance with the present possibilities.

Of course, there are many cases where sewage should be treated for the protection of water supplies, but the object should be to remove an overburden from the water purification plant, rather than take its place.

I do not wish to minimize in any way the importance of sewage purification; my purpose is to point out some erroneous ideas that are only too prevalent. The attitude of many in Duluth in advocating sewage purification in preference to the simple, yet efficient, treatment the water is now receiving, is a very common one. They think when we say purification we mean purification; whereas, the word is used in a comparative sense only, and does not imply purity either from a chemical or a biological standpoint.

While this matter has been discussed a great deal in our technical magazines of late, it must be remembered that these are seldom found in the hands of laymen—and not as often as should be in the hands of city officials and health officers. It would seem well, therefore, if the word purification could be superseded by some word more nearly expressing the thought intended.

### Sewer Maintenance Essential

Before closing, I want to take up another phase of sewage disposal, that of maintenance and supervision. Every sewer system requires some attention, and a sewage disposal plant a good deal of intelligent attention, if results are to be expected from the standpoint of public health or any other. What can we expect when the care and operation of a sewage disposal plant is turned over exclusively to an official, whose major duties require him to catch stray dogs, empty the cuspidors at the city hall and see that the saloons are closed at 12 o'clock—which is the case in many of our smaller communities.

I once complained to an official in regard to a neglected disposal plant, and he stated that as soon as the potatoes were all dug he expected to be in a position to give the matter some attention.

If, as has been often suggested, the attendant at such plants were instructed in regard to making some simple tests, and these results were reported regularly to state officials, preferably, and certain standards were demanded by these officials, who should also visit such places periodically for the purpose of giving instructions, as well as inspecting the operation, we would have reason to expect results. For this reason, I believe that state supervision of sewage disposal plants is equally as important as highway construction. An engineer would then be in a position to design and lay out his work with the assurance that it would be properly cared for and operated.

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## Watertight Joints for Pipe Sewers

*By Philip F. Miller, B. S.*

The problem of making sewers watertight has been a vital one ever since the "separate system" of handling sewage came into use. In former days, when the "combined system" was considered good practice, little attention was paid to joints, as the sewers then were little more than underdrains carrying both sewage and storm water, and, in fact, in many cases it was thought advisable to have open joints so that the sewage would be diluted as much as possible with ground water.

Nowadays, however, with treatment works as the accepted means of sewage disposal, it is essential that the sanitary sewers be laid as watertight as possible, as it is obvious that every gallon of infiltration means extra expense in treatment and pumping. Where cities are so located topographically that the natural slope is in two or more directions, it is considered cheaper usually, to pump the sewage to a common site for settling, filtration or both, so the pumping of sewage is more common than heretofore and the demand for tight joints more exacting.

It is also doubtless true that a considerable saving could be effected in the size

of pipes, as often in calculating sizes of lines, a certain percentage of the flow is allowed for infiltration.

### Causes of Leaks

Where cement joints are used, as is the case today in the great majority of sewer work, the causes for leaks are many. They may be roughly divided into two classes:

Leaks due to poorly made joints.

Leaks due to disturbance of completed joints.

Under the first head comes the country-wide complaint of engineers that the average pipe layer will not see that the space at the bottom of the pipe is properly filled with cement. This, perhaps, is the greatest cause of leaks in sewers today.

In wet work where there is water in the trench, it is nearly impossible to make good joints, no matter how much care is taken, as the cement is more or less washed out of the annular space before it has thoroughly set, unless great care is taken to keep the trench pumped dry for several hours.

Even when cement joints are carefully made the line is often disturbed before the cement has set, thus breaking the bond between cement and pipe and making every joint so disturbed worthless as far as being watertight is concerned. In many cases after a line is well jointed and backfilled, a settlement will occur, either in backfill or foundation, and the line being rigidly jointed will crack, sometimes continuously for a distance of 40 or 50 feet.

### Stoppage from External Causes

As roots of trees will grow into joints where there is an opening of 1/100 of an inch or more, it is often the case that sewers laid near shade trees will in a surprisingly short time become entirely stopped up. Rootlets once into a joint grow rapidly, and cases have been known where masses of roots over 60 feet long have been removed from sewers.

### Trouble Caused by Leaks

The amount of infiltration in sewer lines as ordinarily laid may be far more than is realized by many engineers. In one instance the writer had occasion to visit a disposal plant designed for a maximum inflow of 400,000 gals. per day, and serving a town of some 3,000 inhabitants. According to measurements made at the outfall to the plant, there was no less than 1,500,000 gals. per day being discharged. Needless to say the plant was temporarily useless and the system much overtaxed. In this case the sewers were built by a reliable contractor and designed and inspected by a competent engineer, but the trouble was probably due to the fact that in the summer time when the lines were laid, the trenches were dry and the joints were not as carefully made as they might be, and when they were subjected to a static head of several feet of water, due to excessive rains, the lines developed leaks to an alarming degree.

The writer knows of many instances where, before a single house was connected, sewers carried ground water nearly to the capacity of the treatment plants. It can be readily seen that pumping plants in similar systems would waste a great deal of money by pumping unnecessary ground water. Where excessive leaks occur, sewers often have to be dug up and relaid.

### Properties of a Good Compound

From the foregoing paragraphs, it can be seen that a good jointing should have the following properties:

(a) It should have as its base a material that is absolutely waterproof.

(b) It should set quickly so that disturbance could not affect a completed joint.

(c) It should be flexible to such a degree that a deflection of the line would not cause a leak or crack the pipe.

(d) It should have sufficient weight and be poured hot enough so that it will readily adhere to wet pipe.

(e) It should have sufficient adhesiveness so that a joint once made will always be water-tight.

(f) It should resist chemically liquids likely to be found in sewage.

Such a material usually has for its base asphalt, or a similar bituminous substance with a filler added that will give weight, strength, stability and adhesiveness.

### The Economy of Laying Waterproof Joints

In wet trenches joints made with a waterproof compound, in many instances, are cheaper to lay than cement joints, altho the cost of the material may be greater. This is a fact, because a line jointed with cement must be kept dry for several hours to allow the cement to get its initial set undisturbed, and backfilling should not be started until several hours after that. This means considerable trench pumping and an unnecessary lapse of time before backfilling may be commenced.

Where compound joints are used the water need only be pumped down momentarily while the joints are being poured, and backfilling may be commenced at once. The saving thus lies in the fact that a joint made with a waterproof compound is at once permanent and water-tight and needs no care or labor to prevent damage.

Many contractors prefer to lay joints that they know will be water-tight, even

if the first cost is greater, than to make cement joints that may have to be dug up and repaired.

### Method of Making Waterproof Compound Joints

Waterproof compound joints are made in much the same manner that lead joints are made in water mains, except that no caulking of the material is necessary. The jute is caulked into the pipe in the usual way, serving the double purpose of forming a backing to pour the material against and of centering the spigot in the bell. An ordinary asbestos pipe-jointer may be used or, if one is not at hand, short lengths of ordinary garden hose make admirable "runners." In either case the runner should be greased or smeared with wet clay to prevent the hot material from sticking to it. The jointing material is heated in a suitable kettle to a temperature of from 350 to 450 deg. F., or until it runs freely, and as a general rule, should be hotter for the larger sizes of pipe, as the chilling effect is greater.

An ordinary iron kettle over a wood fire may be used, tho a portable oil-heated kettle is handier. The material should be well stirred while heating, and the kettle should be as near as possible to the point

HEATING *filler for joints.*

where the joints are to be poured so that unnecessary cooling does not take place before the joint is run. A handy method for pouring is to use a dipper that will hold a little more than enough for one joint. It takes from 5 to 15 minutes for a joint to cool, depending entirely on the temperature of the atmosphere, and for rapid work it is advisable to use several runners and make several joints at the same time. In making joints on 8, 10 and 12-inch pipe, much time is saved by pouring alternate joints on the bank by standing two pipes upright, calking the jute and pouring the hot material into the remaining annular space. This obviates the use of a runner and then the double length is lowered into the trench and jointed in the usual way.

The economy of waterproof joints depends largely on the pipe layer, as a careless laborer can spill and waste much material.

POURING JOINT *on bank of trench.*

A depth of material of 1½ inches is sufficient to make a water-tight joint and the use of a greater depth than this is unnecessary.

### Tests

To get an idea of the adhesiveness and stability of a joint compound, a pressure test was made as follows:

Four short lengths of c. i. water pipe were jointed with the material and the ends sealed in a similar manner. Pressure was applied by a hydrostatic pump and run up to 400 lbs. per sq. in. without the sign of a leak. On increasing the pressure to 450 lbs. the plugs began to push out and the sections to pull apart, but no visible leakage was noted for some time. This test led to the question of making water pipe joints with this compound on account of the enormous saving over the cost of lead, but it was found that difficulty was encountered on account of the small annular space in c. i. pipe not admitting sufficient material to overcome the chilling effect of the iron, and good joints were hard to make.

Pressure tests on tile pipe joints made in a similar manner gave good results as

in nearly every case the pipe broke before a leak was detected.

Some tests on spiral riveted steel pipe, such as is used by the U. S. R. S., were

POURING JOINT *in trench.*

made by dipping one end of the pipe in the hot material and forcing it into the end of the other pipe. The lap was only about 3 inches, but the joint stood 300 lbs. per sq. in. without the sign of a leak.

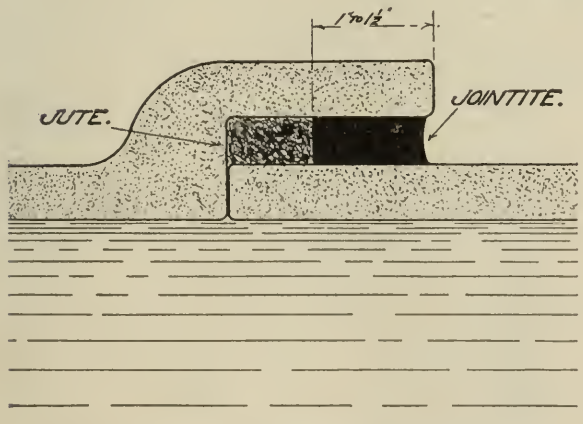


DIAGRAM *of water-proof pipe joint.*

It is extremely difficult to get an idea of the life of a compound, as there are no tests possible that can simulate actual conditions.

The compound used by the writer is entirely inert to the ordinary acids and its waterproof properties should prevent deterioration.

The use of waterproof compounds has been small so far, as compared with cement, but the interest awakened by the idea among engineers and contractors is encouraging, and the use of these compounds is expected to increase greatly this year. Some means of keeping sanitary sewers watertight is imperative and at present the problem seems to be solved in the manner described.

The material referred to particularly in the foregoing article is known as "Jointite" and has been in successful use for about two years.

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## Concrete Example of Value of Waterways

A practical trial of canal transportation was made last year under the direction of Norman D. Fraser, president of the Chicago Portland Cement Company, which he reports as follows:

In August and again in September of last year the Chicago Portland Cement Company undertook to test the utility of the Illinois and Michigan canal. A steamboat and a barge, which were built about thirty years ago, were put in commission and we proved beyond question that the channel is still navigable. Both journeys from LaSalle to Chicago were made in practically four days.

These experiments showed no saving whatever over the all-rail rate, but this was anticipated in view of the small cargoes, 186 and 200 tons, and the antiquated craft at our disposal.

If, however, the Illinois and Michigan canal was dredged and cleaned out to insure a uniform depth of seven feet and the locks increased to 170x35 feet, it would then be possible to operate modern craft capable of transporting in one shipment about 2,000 tons and of making the journey in from two to two and one-half days, which, in point of carrying capacity and time consumed, is, if anything, better than present-day railroad service.

The fleet necessary to transport a cargo of this size, would consist of one steel power boat and five modern steel barges, each 140 feet long, 17-foot beam and 6-foot draught. Their construction and equipment with modern loading and unloading devices, could be undertaken for less than $100,000, $15,000 for each of the five barges and $18,000 for the power boat, but with a steady volume of traffic and good terminal facilities, the saving in the cost of transportation, conservatively estimated at five mills per ton-mile, would, I believe, warrant such an expenditure.

# FIRE AND WATER

## A System of Waterworks Accounts

*By G. S. Olive, Indianapolis, Ind.*

*This article is by an expert in water works accounting and is part of a paper prepared for the Indiana organization of water works men. It states so briefly and clearly the essentials of convenient and accurate accounting as applied directly to water works plants that it is quite complete in itself and will be of interest to every reader who has to do with the accounting for a public service utility, whether under public or private ownership.*

The four principal books of account for any water works should be the general ledger, the general journal, the general cash book and the accounts payable or vouchers payable journal. The last two books are subsidiary to the first, and the general journal is the book of original entry for all items not handled originally thru the general cash book or the accounts payable book. Whatever customers' accounts are kept are also subsidiary to the general ledger. The general ledger is the controlling book. In it appear the accounts showing fixed assets and liabilities, and a summary of the current assets and of the various revenue and expense accounts, the elements of profit or loss, which added to the net investment in the plant, give the proprietary interest. The general ledger should not be a book for details. It should be kept so that at the end of the month, quarter or other period, the vitally important balance sheet, the statement of assets, liabilities, net investment and earnings can be taken from it with the least trouble and in the shortest time. The details of revenue and expense which go to make up the earnings statement can be worked out later; such details call for an analysis of the summarized figures placed on the general ledger and there is no need of holding up the results of operation until it is possible to explain why and wherefore leading to this result. The writer has personal knowledge of utilities which can present balance sheet and earnings statement for any month by the fourth day of the following month, and others where it is an absolute impossibility to get these statements until after the twentieth of the month, the difference being due entirely to the fact that in the second case the general ledger is littered with detailed accounts. It seems at times as tho managers or accountants think they are beating up a dust of secrecy or impenetrability by such methods, but they are really fooling no one but themselves.

Good accounting should contemplate arranging the records in such a way that they will yield the desired information in the shortest time and with the least trouble.

The accounts in the balance sheet given are the essential accounts to be kept in the general ledger. These essential accounts may be analyzed and kept in just as much detail as circumstances warrant. Thus the accounts kept in more detail might be as follows:

ASSETS.

*Fixed assets and funds.*
- *Tangible assets.*
  - Collection system (reservoirs, cribs, canals or wells).
  - Purification system
  - Pumping system
  - Distribution system
  - Miscellaneous properties
- *Intangible Assets.*
  - Franchises
  - Going value
- *Funds.*
  - Sinking funds
  - Depreciation funds

*Current and Nominal Assets.*
- Cash
- Investments
- Accounts receivable
- Prepaid accounts
- Materials and supplies

LIABILITIES AND PROPRIETARY INTERESTS

*Liabilities.*
- Funded debt

Customers deposits
Notes payable
Accounts payable
Accrued interest
Accrued tax
Reserve for unearned income

*Proprietary Interests.*
Capital stock
Reserves
Depreciation
Amortization
Bad debts
Surplus and undivided profits

In addition to these balance sheet accounts, the only ones to be kept are the revenue and expense accounts, which show the earnings of the plant and which are closed off at the end of any period through the profit and loss account, into the balance sheet account, "surplus and undivided profit."

These accounts are as follows:

*Water service revenue*
Rates for metered water
Rates for unmetered water
Rates for municipal service
Miscellaneous water revenue

*Miscellaneous revenue.*
Rents
Interest and discounts
Profits from merchandise and sundry sales

*General expense*
Administrative and commercial expense

*Operating Expense.* (Operation, maintenance and depreciation.)
Collection system
Purification system
Pumping system
Distribution system

The amount remaining after deducting from the total revenue the general expense and operating expense is the net operating revenue. From this net operating revenue, the fixed charges must be deducted. The fixed charges are taxes and interest on funded debt, to which should be added in individual cases such items as sinking fund or amortization revenue charges. The amount remaining after the deduction of the fixed charges is net earnings or deficit and goes as a credit or charge as the case may be to surplus and undivided profit. The accounts given above are meant to be only typical accounts. They can not, of course, cover the needs of every individual plant. The revenue and expense accounts should cover every current asset and liability; otherwise, the net profit or deficit does not show what it is expected to show, the actual result of the operation of the plant.

The fixed charges are ordinarily handled thru the general journal direct to the general ledger accounts. The interest on funded debt account and the tax account should be charged and the accrued interest and accrued tax account credited monthly with that period's proportion of the annual amount due. The practice with reference to revenue is comparatively uniform. The detailed accounts are kept in the customers' ledgers and only the totals of the monthly charges and credits posted monthly to customers' controlling accounts in the general ledger. The credits are made thru the general cash book, charging the cash account, and the charges, thru the general journal, crediting the revenue accounts.

### Expense and Liability Accounts

The keeping of the expense side of the accounts is the best field for missionary work in the entire realm of water-works accounts. Most managers will agree, I believe, that the revenue will ordinarily take care of itself. A water-works plant which does not show a gradual upward trend to its revenue curve is, to say the least, unusual. The expense, on the other hand, needs the most careful watching. Not only the details of the expense need watching, but those details need to be gathered together in such a form that the total expense of the entire plant as well as of its component parts, can be observed by the manager. It has been the tendency in the past to watch the details without paying much attention to the tendency of the entire costs; the superintendents have taken so much time to watch individual invoices for materials purchased that they have lost sight of the aggregate amount. It should be a first principle in all water-works accounting that no cost information should be made up unless it be from an analysis of the general book figures. Accounts or statements made up from any other source are absolutely unreliable.

All liabilities incurred by the plant for general or operating expense should go to the general ledger thru the vouchers payable journal. The pay-rolls or invoices for material purchased, after being O. K.'d by the authorized official, with information on each invoice sufficient to indicate for what use the material was purchased, should be entered on and attached to a voucher payable which includes all the invoices for any month from any one concern and which shows the accounts to which the items are chargeable. These accounts are either expense, betterment or renewal accounts, the betterments being charged to fixed assets and renewals to the reserve for depreciation. The vouchers are entered in the voucher payable journal, the total amount to the credit of vouchers payable in the first column and the amount charged to expense accounts in the appropriate departmental column across the page. Only the monthly

totals are posted from the voucher journal to the general ledger. The same is true of the items from the general cash book and from the general journal. Only monthly totals are posted to the general ledger. Any analyzed information desired concerning the expenses may be obtained from a detailed expense ledger, auxiliary to the voucher payable journal. This method of having the general ledger handle only monthly totals and summaries makes it possible to arrive quickly at the final reults at any closing period.

## Fire Plugs Broken by Automobiles

An accident of such frequent occurence in the city streets as to call for some effective protective device is the breaking of fire hydrants by automobiles. The photograph shows the result of such an accident in a Los Angeles street, caused by the impact of a heavy truck against a

GEYSER *on Los Angeles street corner; fire plug broken by an automobile truck.*

cast iron fire plug. The result of such accidents is the tying up of traffic, sometimes for hours, until the water can be turned off and the hydrant replaced, for the "geysers" throw water into the air to a height of 30 or 40 feet and flood the thorofare. Still more serious is the result when such an accident occurs at the same time as a fire in the vicinity. With a needed hydrant out of commission and a great lowering of the water pressure this is a serious menace. It is a question whether it would be advisable to change the location of hydrants, placing them back from the curb, or to protect them by stout metal posts set in such a position as to receive the blow of the vehicle and protect the fire plug, or set the hydrant beneath the sidewalk and cover it by a heavy metal plate like a manhole cover.

The following report from San Francisco is interesting in this connection:

"The Exposition hydrants are to be a different type from that used by the city and are to be set in the middle of the street in manholes. They will be below the street surface and access to them will be had by raising the manhole covers. This type of hydrant offers no obstruction in the streets and walks when not in use. There will also be connections thru which the fireboats can pump into the system."

## Value of Water Meter Demonstrated

On February 14 Mayor Carter H. Harrison vetoed an order of the city council to the commissioner of public works to remove a water meter from the premises at South Center avenue and West Sixty-third street, presenting as his reason the following from Jos. O. Kostner, deputy commissioner:

"The property consists of a fruit store and flats occupying a building 30x71 feet, two stories high. The meter was installed January 21, 1911. The table given below shows the monthly bills since that date:

January 21, 1911.

| | Gross. | Net. |
|---|---|---|
| February 3, 1911..... | $20.63 | $17.33 |
| (Inspection showed leak in basement.) | | |
| March 23, 1911..... | 10.00 | 8.40 |
| April 21, 1911..... | 2.50 | 2.10 |
| May 24, 1911..... | 3.13 | 2.63 |
| June 28, 1911..... | 2.50 | 2.10 |
| July 24, 1911..... | 2.50 | 2.10 |
| August 23, 1911..... | 4.38 | 3.68 |
| September 21, 1911..... | 3.13 | 2.63 |
| December 19, 1911..... | 7.50 | 6.30 |
| January 19, 1912..... | 7.50 | 6.30 |
| February 21, 1912..... | 10.00 | 8.40 |
| (Inspection showed leaking and wasting.) | | |
| March 23, 1912..... | 8.13 | 6.83 |
| April 23, 1912..... | 3.75 | 3.15 |
| May 21, 1912..... | 4.38 | 3.68 |
| June 22, 1912..... | 5.00 | 4.20 |
| July 24, 1912..... | 3.75 | 3.15 |
| August 21, 1912..... | 3.75 | 3.15 |
| September 24, 1912..... | 6.88 | 5.78 |
| October 22, 1912..... | 6.25 | 5.25 |
| November 19, 1912..... | 5.63 | 4.73 |
| December 19, 1912..... | 11.88 | 9.98 |
| January 23, 1913..... | 30.63 | 25.63 |
| (Inspection showed leaking and wastage.) | | |
| Two years ..... | | $137.50 |

"It will be noted that the revenue to the city from this building in two years was $137.50. The frontage assessment for this building would be at the rate of $34.50 gross, or $29.33 net per annum.

"This is a splendid example of the benefit which the city derives from me-

ters. The owner of this property could reduce his bill to a very reasonable sum by taking care of the plumbing. If he does not choose to do so, it is fair that he should pay for the extra water wasted through his plumbing."

## Thawing Water Pipes by Electricity in Evanston

*By C. C. Saner, Deputy Commissioner Public Works, Evanston, Illinois.*

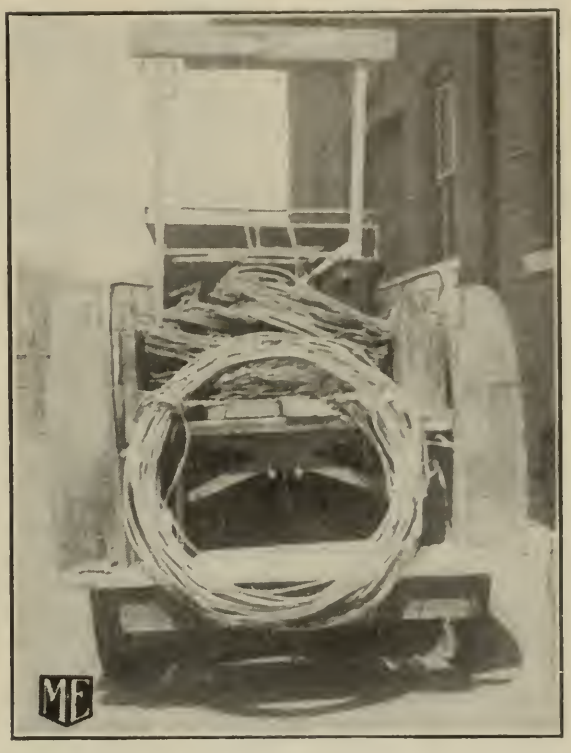
The city of Evanston has owned its water works since their construction almost forty years ago. As the first two months of 1912 were unusually cold and many service pipes were frozen, the city helped relieve the conditions by equipping wagons to thaw out these pipes by electricity. Evanston is in a latitude of 42 deg. 2 min. The soil varies from clay to sand and gravel. The frost penetrated as deep as 5 ft. 2 in. during the winter, and there was fear of the mains freezing.

An examination of the weather records maintained by the department shows that December, 1911, was not unusually cold, the mean minimum temperature being 25 deg. Some snow fell in December, but was melted by rain on the 21st and the 31st. Starting on January 5th, the minimum temperature was as follows: —11, —13, —17, —7, —4, —8, —8, —13, the mean minimum for the month being 0; the mean minimum for February was +14, and for March, +20. The first frozen service to be reported was on January 10, and as several were reported at the same time, the city equipped a wagon with transformers and wire to thaw out these services. The demand was so heavy that another wagon was soon equipped and put into operation. The table shows a record of work done by the second wagon. Numbers 29 and 30 were the first services thawed, and as the crew was somewhat timid about applying the current, three hours were spent using 55 volts and 130 amperes, with no results. When this amount was increased to 110 volts and 280 amperes, the service was thawed in twelve minutes. The largest service thawed was a 4-inch cast iron.

A study of the table will show that the length of lead from the transformer to the service does not bear any ratio to the time taken to thaw the service—110 volts with 300 to 400 amperes thawed most services in from one to ten minutes.

The crew consisted of a foreman, two electricians to make the connection from the primary wires to the transformer and at the service, and two mechanics to disconnect the gas and water pipes, the gas being disconnected to stop any danger of short circuiting and heating gas pipes.

In thawing pipes, the wagon stopped at the nearest pole on a primary line, where connection was made with the electric current. One lead of wire was connected to the nearest fire hydrant and the other lead to the service. Where two services



EQUIPMENT WAGON *for thawing water pipes.*

were frozen in nearby houses, the second house was used instead of the fire hydrant, thawing out two services at once. The crews on this work thawed out eight services a day.

| | Volts. | Amp. | Time of current in use. | No. ft. lead from transformation to serv. con. |
|---|---|---|---|---|
| 1 | 110 | 336 | 3 min. | 300 |
| 2 | 110 | 336 | 7 min. | 415 |
| 3 | 110 | 336 | ..... | ... |
| 4 | 110 | 225 | 40 min. | 420 |
| 5 | 110 | 600-590 | 35 min. | 210 |
| 6 | 110 | 400 | 10 min. | 250 |
| 7 | 110 | 430 | 40 min. | 150 |
| 8 | 110 | 480 | 20 min. | 300 |
| 9 | 110 | 320 | 5 min. | 250 |
| 10 | 110 | 430 | 2 min. | 225 |
| 11 | 110 | 400 | 3 min. | 250 |
| 12 | 110 | 400 | 3 min. | 350 |
| 13 | 110 | 384 | 4 min. | 150 |
| 14 | 110 | 224-35 min. | 40 min. | 150 |
| .. | ... | 304-remdr. | ..... | ... |
| 15 | 110 | 320 | 9 min. | 200 |
| 16 | 110 | 336 | 6 min. | 300 |
| 17 | 110 | 432 | 10 min. | 300 |
| 18 | 110 | 354 | 14 min. | 300 |
| 19 | 110 | 272 | 15 min. | 200 |
| 20 | 110 | 416 | 1 min. | 250 |
| 21 | 110 | 320 | 8 min. | 150 |
| 22 | 110 | 378 | 17 min. | 60 |
| 23 | 110 | 288 | 3 min. | 350 |
| 24 | 110 | 368 | 4 min. | 150 |
| 25 | 110 | 268 | 6 min. | 400 |
| 26 | 110 | 320 | 4 min. | 100 |
| 27 | 110 | 450 | 2 min. | 75 |
| 28 | 110 | 380 | 4 min. | 150 |
| 29 | ... | ... | 3 hrs. | 420 |
| 30 | ... | ... | 12 min. | ... |
| 31 | 110 | ... | 30 min. | ... |

| | | | | |
|---|---|---|---|---|
| 32 | 110 | 320 | 6 min. | 450 |
| 33 | 110 | 560 | 5 min. | 150 |
| 34 | 55 | 280 | 7 min. | ... |
| 35 | 110 | 260 | 28 min. | ... |
| 36 | 110 | 328 | 6 min. | ... |
| 37 | 110 | 268 | 7 min. | ... |
| 38 | 110 | 360 | 17 min. | ... |
| 39 | 110 | 180 | 45 min. | ... |
| 40 | 110 | 260 | 23 min. | ... |
| 41 | 110 | ... | 6 min. | ... |
| 42 | 110 | ... | 4 min. | ... |
| 43 | 110 | ... | 2 min. | ... |
| 44 | 110 | ... | 34 min. | ... |
| 45 | 110 | ... | 4 min. | ... |
| 46 | 110 | 432 | 2 min. | ... |
| 47 | 110 | 368 | 7 min. | 250 |
| 48 | 110 | 352 | 2 min. | 300 |
| 49 | 110 | 268 | 3½ min. | 450 |

## Standards of Purity of Water Supplies.

Efforts were begun in 1894 in the American Public Health Association to establish standards for the analysis of water, including in particular its sanitary analysis. A report on standard methods of water analysis was made in 1905, and a revised set of methods was issued by another committee in 1910, so that the standards are modified as advances in science demand.

The next question is as to standards of purity for water supplies. This is discussed by Joseph W. Ellms, consulting engineer, in a paper before the Indiana Sanitary and Water Supply Association, in which he treats also of methods of controlling the application of these standards and bringing public water supplies into conformity with them.

He states that quite apart from bacteriological methods of examination, we know by observation that settlement, filtration or disinfection of public water supplies leads to a reduction in certain diseases which appear to be derived from drinking polluted water. Indirectly, therefore, it becomes possible to establish a relation between the bacterial content of such waters before and after any method of purification. A polluted water which has had 99 per cent of the bacterial life removed from it can be reasonably agreed upon as safe under most conditions. But whether that water shall not contain more than 100 bacteria per cubic centimeter after purification, or whether it shall not have more than 5 per cent. of one cubic centimeter samples giving evidence of the presence of the bacillus coli, to be considered hygienically safe, is a matter upon which doctors are likely to disagree.

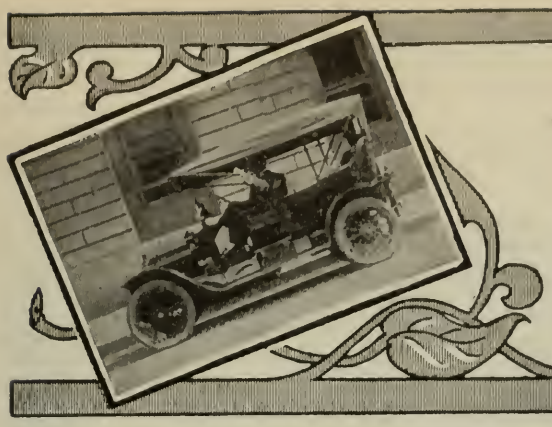
Standards of purity for public water supplies will have little value unless some central authority has power to enforce them upon backward and reluctant communities. Some of our states have vested considerable authority in matters pertaining to water supplies and sewage disposal in the state boards of health. Where such authority is properly exercised and subject to review by legally appointed scientific experts, the best of results may be obtained, i. e., an ignorant or parsimonious community could be protected against its own disregard of sanitary laws. There is a broad field for the exercise of the national government's authority in matters relating to the pollution of interstate and international waters, which may be used as sources of public water supply. If the now scattered bureaus of the national government which pertain to public health were consolidated in a National Department of Health much might be done toward establishing standards of purity for public water supplies, even though the national government was unable to supervise supplies exclusively within the jurisdiction of the several states.

Some of the points which such a body should discuss are as follows:

1. What diseases may be legitimately regarded as water borne? This involves a consideration of the Mills-Reincke phenomenon and the Hazen theorem as set forth by Prof. W. T. Sedgwick and J. S. MacNutt, and the ideas of chronic intestinal tract infection advanced by N. S. Hill, Jr., and L. R. Whitcomb. It means a careful analysis of all the available and reliable vital statistics of those communities having impure water supplies as well as those having pure supplies.

2. A clear definition of what really constitutes a pure drinking water. This means that much light is needed upon the relative numbers and kinds of bacteria, and of the nature and amount of the organic and inorganic matter which may be present in public water supplies, and their significance in the causation of disease. It necessitates the examination of the available bacteriological and chemical data of public water supplies, and their classification in relation to vital statistics.

3. The selection of the maximum limits for the numbers and kinds of bacteria in a drinking water, and the permissible amounts of organic and inorganic matter which such a water may contain. This selection, of course, will be the result of the logical conclusions reached from a study of the compiled statistics, and should be made only after a careful consideration and free discussion of the evidence.



# Automobiles in Municipal Service

## The Automobile in the Police Department

*By William W. Rhoades, Superintendent of Police, Peoria, Illinois*

The police department was the first department of the city of Peoria to transform its equipment from the horse-drawn vehicle to that of the gasoline machine.

With the substitution of the old police patrol, which for many years hauled the city's wrongdoers to the calaboose behind two horses, by a great auto patrol, and the like change in the ambulance service, the police department was completely renovated. The change has by no means been so great as that which will be necessary to rejuvenate the fire department, but it has been none the less important.

WILLIAM W. RHOADES, *Superintendent of Police, Peoria, Ill.*

The installation of the Gamewell electric signal system made of the Peoria police department one of the most efficient in the United States. Costing many thousands of dollars, this system enables the officers at the central station to obtain the patrolmen on the beats at a moment's notice by means of the flash lights and the bells. This installation is but one of the few installed in this country, and it brought the Peoria department to a high standard. But it remained for the biggest improvement of all to come within the past year when the new auto patrol and auto ambulance were placed in commission. Both are built along the same lines and with practically the same equipment and cost in the aggregate somewhat over $5,000. The patrol was the first to be put into commission, and so great was its success that the appropriation necessary for the purchase of the ambulance was soon obtained. The two are practically the same in both power and outline, the only difference being that the ambulance is fitted especially for the accommodation of stretchers for the sick and wounded, while the patrol is arranged with benches for the disturbers of the city's peace. Either can be used in an emergency to assist the other, should the demands become too much for the one machine to handle.

The improvement of the new automobile over the old style of horse-drawn vehicles cannot be overestimated. So great has been the increase in the efficiency of the department with the automobiles in commission that the slight increase in cost is far counteracted. The combination of the Gamewell system, designed to make more speedy the workings of the department, with the new autos, makes the department one of the most efficient branches of the city's service.

The police patrol, in particular, is called upon to make quick trips to the remotest parts of the city. The need of promptness in this department is no less pressing than in the fire service, and while in the latter there are wagons stationed in every part of the city, the police branch has but one central station many miles from some of the beats which the patrolmen cover. Formerly a run to the remote police box at the corner of Washington and Western avenue in the extreme south end of the city, an important station, and

one which required the service of the patrol many times each week, occupied nearly, and sometimes more than an hour. Now the round trip can be made in less than fifteen minutes.

Under the old system, should the patrol be out on one of these long trips, and another call came in, it was necessary to call on the ambulance, and should a third call then come in, the police department was helpless. Under the new system such an event is practically impossible. There has not been a time since the two were in commission that both were outside the patrol house on Madison street for a period as long as five minutes. This one consideration alone would be enough to justify their use.

MOTOR PATROL AND AMBULANCE, *Department of Police, Peoria, Ill.*

But it is in disasters like the Wollner Distillery accident of last spring, when 20 Bradley Institute students were injured by the falling in of a floor, that the full force of this argument is felt. At that time the auto-ambulance had not yet gone into service, and it was the patrol which did the major portion of the work. When the call for help came in, both machines were sent out. And as the patrol was dashing to the distillery for its second load of sufferers, it passed the rapidly-tiring horses on their way to the scene of the accident for the first load.

Our machines were operated and maintained for one year for $226.78 less than horse-drawn vehicles for a similar length of time.

## Motorizing Pittsburgh Fire Department

The city of Pittsburgh, Pa., has not yet made much progress in motorizing its fire department, altho the steep hills so general in its topography would seem to demand it. Up to the first of the year 9 combination chemical and hose wagons and one tractor to attach to an engine in service had been purchased. Three new tractors will be delivered soon.

A bond issue of $240,000 for motor apparatus was voted in November, 1912, and the council has authorized the expenditure of $120,000 of this in 1913. Bids are now asked for 15 combination chemical and hose wagons, 4 motor tractors and 3 steam fire engines with motor traction.

## The Motor vs. The Horse

*By W. P. Weeks, Chief of Fire Department, City of Battle Creek, Michigan*

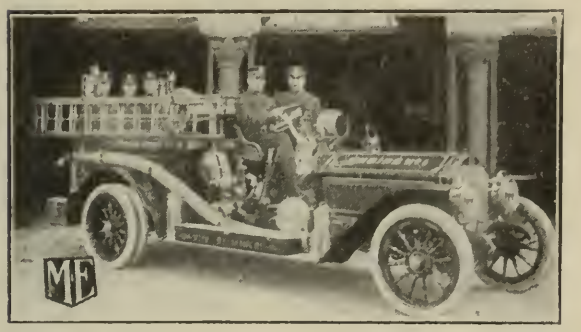
With the advent of motor-driven fire apparatus, we have cut our total fire loss four-fifths in two years.

The average up-keep for motors is but 14 cents per day, while the up-keep cost on horse-drawn apparatus runs to $1.20 per day.

MOTOR APPARATUS, *Battle Creek, Mich.*

We recently recommended the purchase of a motor truck, costing $5,500 and driven by a motor the size of the one now in our pumping engine. This will replace the three-horse aerial truck that now costs $1.80 per day to maintain, as it is necessary to have three horses to pull it. In

addition to this, the truck trails the motor apparatus, arriving several minutes later than the automobile. Few people realize the importance of having a fast truck to work with the fire department. It is the fireman's tool box. The heavy tools that cannot be loaded on the other



SIX-CYLINDER *chemical engine and hose car.*

apparatus are carried here. In addition to this, there are all of the life-saving devices, such as nets, ladders, ropes, and similar apparatus. This should be on the ground as soon as the firemen are, if it is to be of any use in saving lives.

Our truck is driven by a 6-cylinder engine, and carries a 40-gallon chemical tank, all the life-saving equipment, including nets and ropes, pompier ladders, an arrangement for climbing from story to story of a tall building, a 50-foot ladder, two 35-foot ladders, and one each of 30, 25 and 20 feet. There are also two 14-foot ladders for roof work. All of these are of special reinforced construction and very light.

One of our recent improvements was the addition of a $9,000 triple pumping en-

CHIEF'S CAR, *Battle Creek, Mich.*

gine, which is a whole fire department in itself, taking the place of five horses, and furnishing as much apparatus as is kept at No. 2 station. This one car carries a pumping engine, pumping 700 gallons of water a minute; a chemical engine, a hose motor car, with ladders, hooks, and other tools for fighting fire. In the six months it has been in use, it has cost the city $75.00 for maintenance.

A 3-horse truck costs the city $663 a year for maintenance. During the past year the city has paid out $2,652 for the up-keep of its 12 horses, which exceeds by far the cost of the motor apparatus, and added to this is the fact that the motor apparatus gets to the fire quicker than the other.

Our department now owns the following motor apparatus: One 50-h. p., 4-cylinder

75-H.P. *chemical and hose squad car.*

automobile, 1 75-h. p., 4-cylinder combination chemical engine and hose squad car, 1 6-cylinder triple combination pumping engine (700 gallons capacity), chemical engine and hose wagon; 1 105-h. p., 6-cylinder combination chemical engine and city service hook and ladder truck.

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## Modernizing the Hartford, Conn., Fire Department

*By David A. Nicholls, Hartford, Conn.*

Seven years ago the city of Hartford, Conn., had a fire department as good as the average fire department of a New England city of its size. It had permanent men, some good apparatus, and had had good success in handling fires. Yet the city was growing faster than the partment could afford to grow, and the serious problem of the expansion of the department faced the city officials.

In one of the fire stations was an especially antiquated old piece of apparatus, an old one-horse hose reel, an eyesore and a menace to the men who had to ride on it. This piece of apparatus opened the way for a modern fire department. The station was even more antiquated than the old reel and was not large enough to hold a modern hose wagon and another horse with what was already there. The house was too old to enlarge and the city could not build a new fire station.

The automobile was the solution of the problem, as it would take no more room than the old reel and cut out one horse.

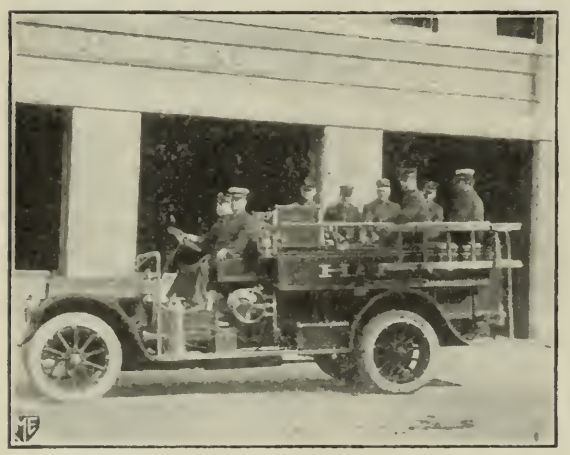
The wagon had to be eventually rebuilt,

a four-cylinder engine replacing the two-cylinder that it was originally equipped with. Then it was found that the automobile could get to the fire faster, cost less to maintain when not in actual service, and was more efficient.

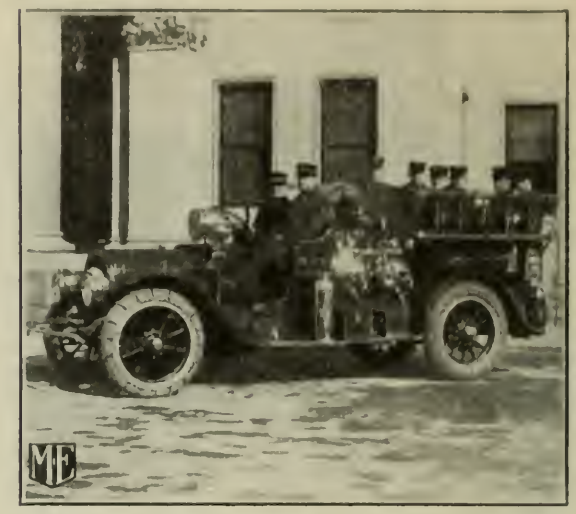
Then the chiefs gave up their buggies for cars. In 1910, another automobile added proof that horses are no longer of use in fire fighting, so that before long the Hartford fire department will be horseless.

A chemical company of five men, located on Pearl street, known as No. 9, answering only a few alarms in the heart of the city, was replaced by a flying squadron of 8 men in a Pope-Hartford automobile, equipped with two 40-gallon chemical tanks, to answer all alarms. Without the cumbersome load of 2½-inch hose, it has many times reached the fire, several miles away, before the nearest horse-drawn company, sometimes only two or three blocks away. This company, known as Squad A, has paid for itself many times over. In over three years it has been responding to all bell alarms, as well as attending to many still alarms in the center of the city, and has not had one serious accident.

Last August the Pope-Hartford Company supplied three more hose wagons, new models, an improvement over the first one. They are chain driven, are larger, and, besides carrying a 40-gallon chemical tank and 300 feet of one-inch chemical hose, each carries 1,000 feet of 2½-inch hose, with the other usual paraphernalia. They are located one to reach western points of the city quickly, another southern points, and another northern points. In each case the company is quickly reinforced by Squad A, and by the time the horse-drawn companies get there they are seldom needed. This has saved building several new stations this year, which, without automobiles, would have been imperative because of the rapid growth of the city. A new tractor-drawn engine was added last fall, doing away with three more horses, and giving far quicker service to parts of the city where several bad fires have occurred for the want of an engine in the early stages of the blaze.



HOSE WAGON, *Hartford, Conn.*



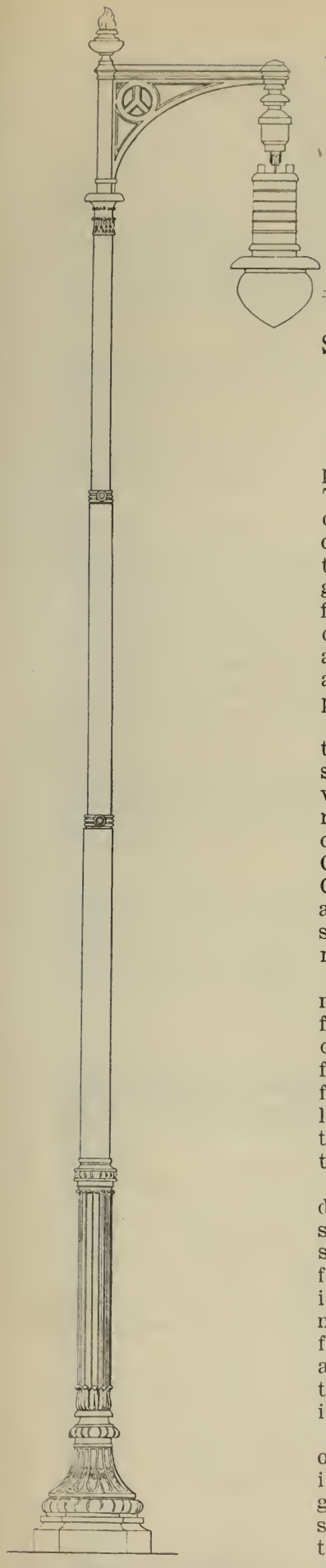
FLYING SQUADRON, *Hartford, Conn.*

Chief Augustus Loomis has recently completed a tour of a number of cities where motor apparatus is extensively used, and his report is overwhelmingly in favor of an entirely motorized department. If this is done, it will mean a saving of nearly $11,000 a year on the fodder bill alone, to say nothing of the saving of replacing floors frequently where horses have worn them out. It will take two drivers in nearly every one of the fourteen companies affected and make them available for fire duty after they have motored to the fire, a clear gain of 28 working men for fire duty.

It will cost Hartford approximately $100,000 to motorize and, at the next city election, the voters will be asked to approve a bond issue for that purpose.

Hartford is really a pioneer in self-propelled apparatus. The first steam propeller was put in commission in this city in 1878. At present there are two heavy steam propellers, but these will probably give way to the tractor, as the sparks flying from the stack often set fires along the route. Besides, they are cumbersome and not as speedy as the tractor, and are a constant expense, in service or out of it, as a heavy pressure of steam must be kept up every minute, ready to start out under power when the gong calls. The saving in coal here is second only to the expense of feeding a lot of horses that are working only a small fraction of the time in the outlying sections.

The accompanying pictures show the two types of cars now in service. One, the lighter car of the flying squadron, and the other the hose wagon that is worth half a dozen horse-drawn hose wagons.



ORNAMENTAL ARC LAMP STANDARD

# STREET LIGHTING

## Standard Lamp Post Adopted in Chicago, Illinois

*By J. C. Schniedwind, Chicago.*

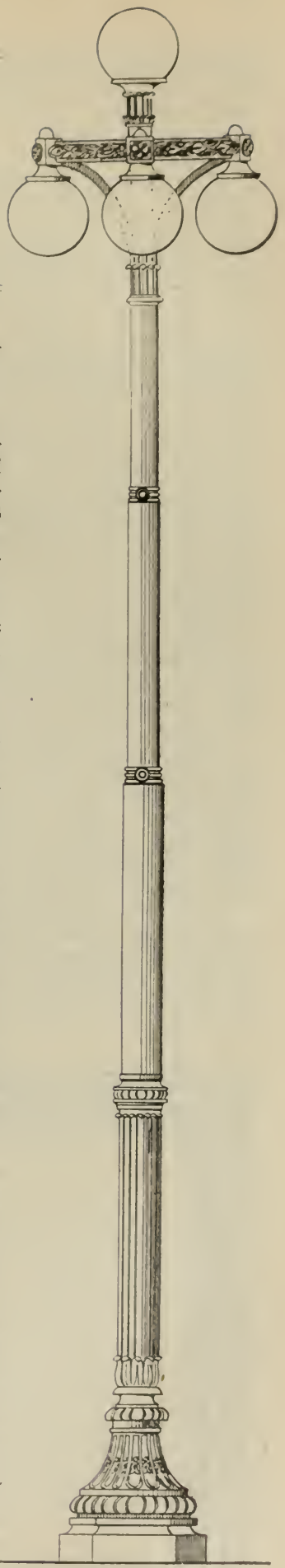
On July 17, 1911, a committee was appointed by Mayor Harrison composed of 7 aldermen, 3 representatives of the Chicago Plan Commission, 3 representatives of the Chicago Association of Commerce, the City Electrician and the electrical engineer of the sanitary district of Chicago, for the purpose of establishing a uniform design for posts, globes, etc., for electric arc lights for streets, and reporting upon an ordinance, providing for standard posts for electric street lighting.

After having given much thought and time to the subject, and after having considered all designs, models, ideas, etc., which were presented to them, this committee drew up a report and a proposed ordinance, which was presented to the City Council, which ordered it published. On January 27, 1913, this ordinance was again submitted to the City Council, slightly amended, and passed unanimouslly.

To provide for uniformity and yet permit of variation, the ordinance provides for three types of posts, namely, posts for commercial incandescent lighting, posts for outlying district arc lighting and posts for downtown district arc lighting; the limits of these districts to be defined by the City Electrician, who is empowered to change same at his discretion.

The ordinance provides for a specific design of posts for each classification, as shown by accompanying drawings. No. 1 shows accepted design of standard post for commercial incandescent street lighting, No. 2 shows accepted design for ornamental iron post and bracket approved for arc lights in downtown district. That approved for arc lights in outlying districts differs from the latter only in having no ornamental iron work on the post.

Where posts are used for the purpose of commercial incandescent street lighting, they must be constructed of a good grade of cast iron and conform to the design as shown. The height of the post thruout the city, except in the business



ORNAMENTAL INCANDESCENT LAMP STANDARD

district, shall be such that the center of the lower globes will be 12 feet above the curb adjacent to which it is placed. In the business district the height of 12 feet is changed to 16 feet.

The post for downtown district are lighting is to consist of one malleable iron bracket, one tubular steel mast, two cast iron section collars, one cast iron ornamental collar, one cast iron pole top and one cast iron base, as shown in Fig. 2. The mast is to consist of three sections, respectively, 4 inches, 5 inches and 6 inches in diameter, the brackets to fit snugly, the section collars to be sliding fits on the 4-inch and 5-inch sections of the mast. The ornamental collar adjoining the mast is to be a sliding fit and held snugly in place over the 4-inch section of the mast and the ornamental base to fit snugly over the 6-inch section of the mast. The height of the post is to be such that the arc of the lamp will be 25 feet above the top of the curb, adjacent to which it is placed.

The specifications for the post for outlying district arc lighting, with the exception of ornamentation, are the same as for the downtown district, other than the height of the arc is 22 instead of 25 feet.

The materials of which the post is constructed must pass certain tests enumerated in the ordinance; where castings are uesd they must meet all requirements provided for in specifications governing same, as adopted by the American Society for Testing Materials.

Previous to assembling post, the mast after being thoroly cleaned, must be given a coat of red lead or subjected to a Sherardizing treatment; all castings are to be given a brush coat of red lead and oil.

After having been assembled and erected, a coat of weather proof paint of a color harmonizing with the local surroundings is to be applied to the post. Final choice as to color rests with the city electrician.

The posts for incandescent lighting are to be fitted with five lamps, one at the top of the post with a 12-inch globe and, 2 feet below, four lamps at right angles to each other, each to be fitted with a 9-inch globe, all globes to be of an approved diffusing glass, so constructed as to subdue the light intensity.

All posts are to be set in a rectangular body of concrete from the bottom of the post to within 3 inches of the curb grade, the depth depending upon the nature of the ground, approximate depths being as follows: Sand, 5 feet; clay, 4½ feet, and rock, 2½ feet.

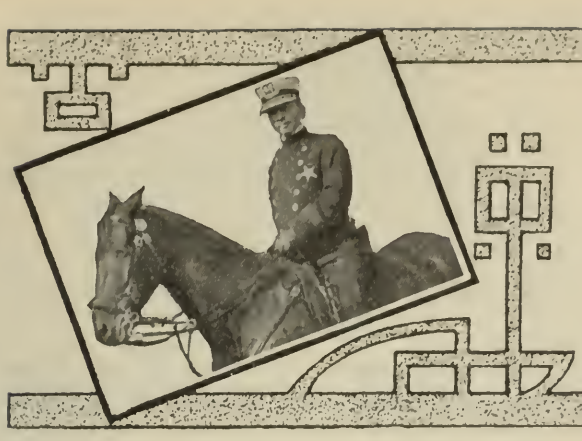
Owing to the large number and varied designs of posts used in commercial incandescent street lighting, which have already been installed at various times thruout the city, provision has been made to exempt them from a violation of the ordinance, providing that within a period of six years these posts are made to conform to the adopted standard governing their location.

As conditions at times will not permit of a full compliance with the provisions of this ordinance, the city electrician is empowered to sanction such changes as he deems advisable.

To facilitate compliance with this ordinance the city electrician, Ray Palmer, will furnish all responsible lamp post manufacturers with detail drawings and specifications governing the construction of the standard lamp post.

## Enormous Savings for People of Los Angeles, Calif.

The Board of Public Utilities is engaged in making detailed inventories and appraisals of the properties of all the public service corporations operating in the city of Los Angeles, together with an investigation of their receipts and operating expenses. In addition to the reports which the companies are required to furnish the board, independent statements are made from the books of the companies by the board's accountants, and a continual check is kept on the companies' operations by the engineering and accounting staff. One of the benefits to the people from the regulation has been a substantial reduction in rates, the estimated saving to consumers being more than $500,000 in electric rates, over $250,000 in gas rates, and of over $300,000 due to the increased heating value of gas, brought about by the board's supervision of the gas inspection department, making a total saving of $1,050,000 for gas and electricity for the year 1912.



# LEGAL DECISIONS

## Effect of Inspection and Acceptance Upon Pavement Guaranty

The Louisville case referred to in the article on "Paving Conditions in Southern Cities" in MUNICIPAL ENGINEERING for February, p. 73, has been decided by the Kentucky Court of Appeals. The case as stated there turns on the claims of the contractor that the specifications were defective and that the approval of the inspector and acceptance of the street by the city relieve him of responsibility under his guaranty. The peculiarities of the case, the assumption by the judge of engineering knowledge and the errors in conclusions which he makes on account of his lack of engineering experience make the opinion of the court of interest enough to warrant publishing it almost in full. The title of the case is City of Louisville v. L. R. Figg Co.

It was agreed in submitting the case that should the court be of opinion that it is the duty of appellees under their guaranty to remedy the admitted defects in the work which they did under contract with the city, they will proceed to do so under the supervision and direction of the Board of Public Works and pay the costs of the action; but that if it should be determined that appellees were not required to remedy the defects in said work, the action should be dismissed at the costs of the city.

In 1910, the contract for the reconstruction of part of Seventh street with vitrified brick was entered into under carefully prepared specifications, including:

"The party of the second part hereby guarantees the work done under this contract, and the materials used in the construction of the same are free from defects or flaws, and this guarantee is for a term of five years from and after the acceptance of the work by the Board of Public Works. It is hereby especially agreed and understood that this guarantee shall not include any repairs made necessary by any cause or causes other than defective work or materials in the construction of the improvement."

All agree that the street is now badly in need of repair and that the bricks, cement and sand used in the work were up to the specifications.

The city claims bad workmanship or imperfect preparation of materials, while the contractor claims that the specifications were at fault. The only direct evidence in the record as to whether these specifications were strictly followed is given by L. R. Figg; and the city engineer, who, of course, was only present for a short time each day while the work was in progress, testifies to no single fact which came under his personal observation, showing that the specifications were not strictly adhered to. Inspectors and assistant engineers were not called as witnesses.

Many expert witnesses were introduced by both sides, some of them learned and experienced as to the construction of vitrified streets, and as might be expected, their evidence, based upon hypothetical questions, is in some respects very conflicting.

Most of the expert testimony of the city was directed at proving that the cement grout or filler which was required to be used after the bricks were laid, was not properly mixed or applied as required by the specifications; that if it had been properly mixed and applied, it would have gone down in between the bricks and cemented them together so as to form, after it was firmly set, a solid monolithic mass, which would have had ample strength to resist any expansion.

The preparation and manner of applying this grout filler were prescribed in minute detail in the specifications, and appellees' evidence shows strict compliance therewith; the city engineer says that it was done in accordance with the specifications while he was present. The city's complaint is that this grout was not prepared or applied so as to fill the cracks between the bricks down deep enough; but that by reason of its im-

perfect preparation or application, in many places, it only went down one-quarter or one-half inch from the top of the bricks, and did not, therefore, after it was set, make a strong or solid monolithic mass, whereas, if it had been properly prepared and applied, it would have gone down in between the bricks to the bottom, or near the bottom, and would in that way, after being being set, have composed a solid and practically indestructible street.

Many of the bricks taken from the street disclosed this, but appellees contend that this was because after the brick were laid on a loose layer of sand two inches thick, they were required to be rolled in such manner, and to such extent and with such weight, as to force the sand up between the cracks in the bricks and for that reason the grout could descend only until it met the sand.

It is altogether reasonable that with the enormous weight required by the specifications rolling over and over the bricks after they were laid on the cushion of loose sand, the pressure would cause the sand to come up between the cracks in the bricks some considerable distance.

The evidence discloses that some time after the completion of the work when vehicles would pass along the street, there would be a rumbling sound, thereby tending to show that the expansion had caused the bricks to buckle or raise from the concrete foundation, and that heavy traffic over it while in that condition would break and shatter the bricks; this was clearly one, if not the chief, cause of the imperfect condition of the street. The evidence is ample that this is a natural result where no provision is made for such expansion and contraction.

The specifications provided for expansion cushions on each side of the street next to the curbs, and prescribed its composition and dimensions; but no provision is made whatever for an expansion cushion lengthwise of the street, and the witness, L. R. Figg, states that on many occasions during the progress of the work, he notified the city engineer and the city officials that there ought to be expansion cushions every fifty or seventy-five feet lengthwise of the whole work, which was 744 feet long.

It is in evidence that the temperature in the city of Louisville varies 120 to 130 degrees at different times of the year, and it is perfectly manifest from a common sense view that these extremes of temperature should in some way be provided for in the construction of such work.

The court concurs in the finding of the chancellor in the lower court that the condition of Seventh street was primarily due to the expansion of the materials with which it was paved, and that under the specifications no other result could have been reasonably expected, and that the city has failed to show that appellees in any way failed to live up to the specifications.

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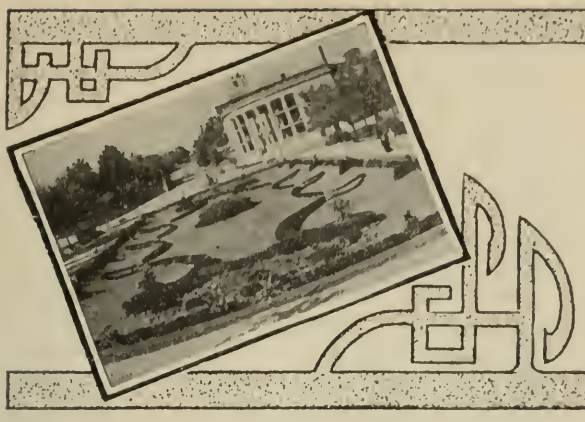
## Highway Construction by Federal Government

That National Government participation in the highways progress of the country should first concentrate itself upon main roads was the predominant current of opinion in the Second Federal Aid Good Roads Convention, held in Washington, D. C., during inauguration week. Called by the American Automobile Association, motorist delegates, nevertheless, were in the minority, as general roads bodies and chambers of commerce supplied the greater part of the several hundred representatives from the forty-six States, which, in one form or another, were embraced in the nation-wide gathering.

No more concrete summing up of the situation was expressed than that employed by Charles B. Stetson, Chairman of the Executive Committee of the National Grange, who, in concluding his address, said: "We do not believe that Federal Aid means the appropriating of National funds for local improvement of roads. It is certainly wrong to ask National aid to do what properly belongs to the local community to perform, and in any good roads movement the State is the unit to which the municipality should look for aid, and the State in turn to cooperate with the National Government for interstate roads and other roads that are of sufficient importance to warrant the employment of National aid in building. Any other course is untenable, unconstitutional, and basically wrong. But we do ask of the men who are trying, and conscientiously trying, to build interstate and transcontinental highways to remember the necessity of improving the road from the home to the city of the man who is promoting the great basic industry of our country to the end that all the people in this great country may ultimately be benefitted."

The resolution passed recommended the Federal Government to build and maintain an interstate system of highways connecting the capitals of the various States, and with the National Capital; the creation, wherever they do not now exist, of effective State Departments of Highways; a standing committee of Congress on National roads, a restoration of the tobacco tax of 1879, and the use of the excess in building a National or interstate system of highways.



# CIVIC BEAUTY

## Smoke Nuisance in Salt Lake City, Utah

*By Jesse C. Coogan, Chief Engineer, Coogan Engineering Co., Milwaukee, Wis.*

During the past three years I have made a special study of fuels and combustions, as they are a most important adjunct of my profession and business as a heating engineer, designer and contractor for large power plant equipment. Although I have had twenty-four years' practical and technical experience, it was only three years ago that I entered seriously into the question at issue, viz., fuels and combustion. Of late I have been devoting considerable study to the smoke nuisance in Salt Lake City, Utah.

Education and scientific firing will not cure the smoke nuisance in Salt Lake City, since it is impossible to legislate brains, intelligence and energy into the men behind the shovel that feed 95 per cent. of the heating and power boilers of the city, if the equipment they handle is not of a kind and arrangement by which they can secure smokeless results, and at the same time produce work intended.

Directly or indirectly, however, any legislation that will cause an abatement of the smoke nuisance will cause a gain and a profit, inasmuch as smoke issuing from a chimney represents just so much waste, as smoke is nothing more than minute particles of pure carbon carried off from the fire in gases that are insufficiently heated to burn.

The quantity of heat given to a boiler is determined by the final state of the gas escaping to chimney stack. If nearly perfect combustion has taken place in the furnace of a boiler, we are able to obtain an efficiency of as high as 75 per cent., by which is meant that 75 per cent. of the actual heat in the fuel is transmitted into work as represented by the heat generated by the boiler for heating or power purposes. The other 25 per cent. is a loss that cannot be avoided, as it represents loss resulting from radiation, due to boiler construction and gases escaping into stack, which are necessary to cause draft, etc.

Whenever dense smoke issues from a stack we can safely say that it represents 75 per cent. of the actual heat in the fuel that causes this smoke and the gases carried with it; therefore, Mr. Owner is losing just 50 per cent., or one-half, of what he could save if his furnace was of a type that turns this smoke and escaping gases into useful work by burning them at a high temperature and converting

JESSE C. COOGAN.

them into useful work. Therefore, any legislation compelling the use of furnaces that will not cause smoke will, per se, result in a direct economy and consequent saving in fuel.

It is for this reason that in cities that have compelled absolute obedience of smoke laws and ordinances, owners have learned the great economy of using smokeless types of boilers and are satisfied with them, after it has been driven into their heads by practical experience that instead of being a hardship the com-

pliance with anti-smoke laws is a benefit, inasmuch as it invariably results in a saving of fuel as well as a much higher efficiency from boilers.

A time-worn excuse for not installing smokeless boilers is the claim that there are not satisfactory ones on the market. This is a poor and false excuse, and there are several on the market at the present time, and the prices are most reasonable considering their many benefits.

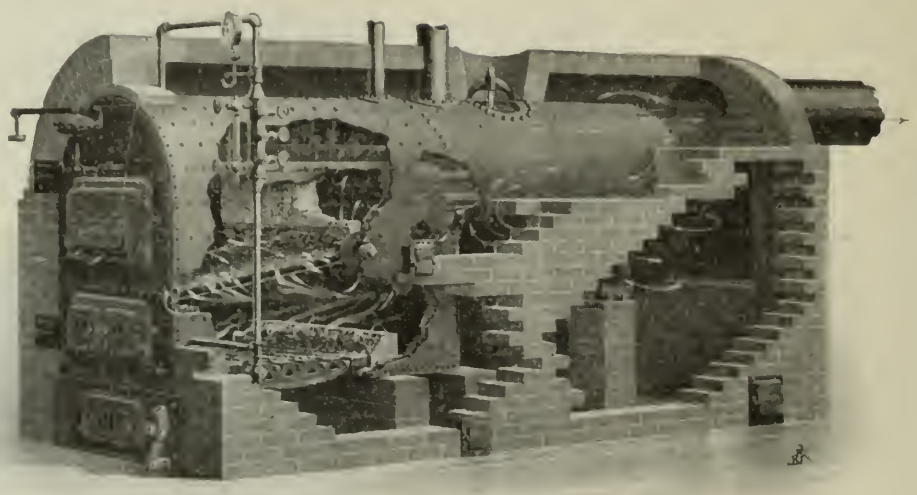
Some of our foremost manufacturers of steel heating boilers have placed on the market in recent years various types of smokeless boilers, so that the question of price or availability should not be considered a legitimate excuse.

As a further evasion, some owners will claim that the mechanically operated stokers and furnaces are expensive to operate and require experienced and high-priced labor. For their benefit, I will say that there are several different makes of hand-fired smokeless boilers now in use in Salt Lake City.

I recently installed three hand fired boilers, of down-draft type (Kewanee smokeless firebox boilers) for Granite school district. They have been found to be not only smokeless, but far more economical than any other type of hand-fired boiler in use in Salt Lake City, or elsewhere, where bituminous coal is available. These boilers above mentioned are used in connection with the Coogan hot-water system.

Various cities have smoke laws and most of them are effective. All thinking, sensible men will agree with me that scientific or intelligent firing by hand cannot be depended upon, and, therefore, other measures must be adopted to secure the desired results. As the question is a large one and concerns many owners of boilers, the solution cannot be arrived at in one day nor in one season, and hence I believe my suggestion as to the solution of this problem will be not only effective, but very reasonable. I suggest that a law be passed by the present legislature empowering Salt Lake City to create a commission on smoke abatement and have the members thereof appointed by the mayor, this commission to consist of not less than five members, two of whom shall be practical and experienced engineers and one a technical man of high standing. The other two members may be laymen if so desired. Then provide that any and all new boilers over 75 square feet of heating surface capacity must be of a type and size approved by the commission before installation.

Let the law provide that any and all boilers in use in Salt Lake City or within one mile of city limits must be inspected and approved and the owners furnished with a certificate of approval, without which certificate the commission will have authority to close down and seal up said boiler until proper arrangements are made to comply with the law. This section of the law will cause owners of present boilers to arrange to comply with the law. Provide a heavy penalty.



TYPE OF FIRE BOX *used in Salt Lake City, Utah.*

Also let the law provide that no stack or chimney shall emit dense smoke for a longer period than a total of five minutes in any hour of the day or night. This will permit of cleaning of fires once each hour, at which time some smoke may be necessary, although fires as a general rule are not cleaned more than two or three times per day.

Next I would allow any citizen to make a complaint against the owner or user of any smokestack or chimney that emits dense smoke for more than a total of five

minutes in any hour. Make each case a jury case, and if any kind of competent and reliable testimony is presented, you can take it for granted that Mr. Owner will generally and quickly be found guilty. The doubling up of fines is in use in Leeds and other English cities, and has resulted in almost a complete abatement of the smoke nuisance in those cities, where the poorest kind of coal is in use.

The chief commissioner should receive a large salary, and his requirements for office should be a complete practical and technical knowledge of heat and heating, as well as of fuel and combustions, so that complete confidence could be placed in the correctness of the rulings and in the judgment of the commission. The commission should be provided with a secretary, whose duty it will be to respond to calls of citizens regarding complaints. The secretary should be provided with a camera, and take photos of stacks every half minute when smoking, and be prepared to swear to the correctness of the photos and the time of taking, etc. This method is used in Milwaukee, and has resulted in one of the cleanest factory cities in the world.

Another great good accomplished by this commission would be the elimination of a lot of worthless devices that are palmed off on owners as "smoke consumers," "smoke preventers," etc., most of which wind up in the junk pile after only a short usage has proven them to be of no value whatever.

Practical and experienced stationary engineers would welcome a law of this kind, as it would compel a greedy owner to replace defective or deficient boiler equipment, which is notoriously unable to operate without smoking badly, no matter how much brain and brawn is furnished by Mr. Engineer or the firemen under his control.

Other details and duties of the commission could be worked out, but in the main the above will answer the purpose of positively cleansing the otherwise beautiful city of Salt Lake. I do not believe a single taxpayer or citizen possessed of an ounce of civic pride would or could object to the comparatively small expense that would be entailed in the adoption of this, the only positive remedy for a situation that is fast becoming unbearable to the pride and the health of the citizens of Salt Lake City.

## Chicago May Rename Streets

The street nomenclature sub-committee of the city council of Chicago, after nine months of investigation, has submitted a report which would completely reorganize the street names of Chicago, and, it is claimed, for the first time in the history of the city, weaves them into a system that is concrete, easily understandable and practical.

If the changes go into effect they will be felt by practically every person in the city. They will mean corresponding changes in the names of elevated railroad stations, in telephone and city directories, and in addresses.

The committee's report is not final. It will go to the committee of streets and alleys, taxation, and street nomenclature, where objections will be heard. With such changes as are ordered by this committee it will go to the city council for final approval.

The plan followed in the report is that set forth in a letter written by Mr. Riley and made a part of the report of the committee on street nomenclature, published on March 4, 1912, in the council proceedings. This letter favored a system of street naming which would cover the following:

1. Elimination of all street name duplications.
2. Changing of all diagonal thorofares from avenues to roads.
3. Elimination of all numbered avenues on the west side and substitution of names.
4. Changes of all named streets which run east and west on the north side to numbered avenues in conformity with new numbers system.
5. Naming of all east and west streets between hundreds as numbered terraces.
6. Assigning of one name to all continuous thorofares now known by different names in different sections.
7. Establishment of alphabetical plan for renaming streets running north and south. Under this scheme a certain letter would be assigned for each mile, beginning with "A" for the mile west of the Indiana state line; all the streets within that mile being given names beginning with that letter.

The extent to which changes were necessary in following out this plan is indicated by the following figures: There are now in use in Chicago 1,761 street names. Of these 578 are duplications. The report now submitted eliminates 400 of these duplications. Of the total number of streets 885 are streets on the same line but with different names. Of these names 416 are eliminated by the report.

The total number of streets changed is 816. The alphabetical system suggested by Mr. Riley involved the assigning of 226 new names and twenty-three names have been assigned to streets hitherto without titles. The total number of streets remaining in the city, by the terms of this report, is 1,171. In other words, fifty-nine street names have been wiped out by the report.

# PERSONAL

## Illinois Water Supply Association

The fifth annual meeting of the Illinois Water Supply Association was held at the University of Illinois on March 11 and 12. The membership of the association is made up of water works engineers, superintendents, chemists and others interested in obtaining and conserving an abundant supply of pure water. The papers read at this meeting covered a wide range of subjects, including the study of deep well drillings in Illinois, sterilization of water by ultra-violet light, filter plants, practical methods of obtaining efficiency in water works pumping plants, bacterial examination of water supplies, conditions in small filter plants, appraisal of water works properties, fire streams and municipal laboratories. About 125 members attended the meeting. The officers elected for the next year are: President, C. H. Cobb, Superintendent, Kankakee Water Works; First Vice-President, H. M. Ely, Superintendent and Manager, Danville Water Company; Second Vice-President, W. J. Spaulding, Commissioner of Public Property, Springfield; Third Vice-President, V. E. MacDonald, Superintendent, Lincoln Water and Light Company, and Secretary and Treasurer, Professor Edward Bartow, Director, State Water Survey.

## Association for Standardizing Paving Specifications

After two days of deliberation over changes in the specifications adopted at previous conventions, the Association for Standardizing Paving Specifications elected as president Norman S. Sprague, the superintendent of the Pittsburg bureau of construction; vice presidents, Nelson P. Lewis, New York; Geo. W. Tonson, Toledo, O.; Linn White, Chicago; W. P. Hempelmann, St. Louis; secretary and treasurer, John B. Hittell, Chicago. The question of amalgamation with the American Society of Municipal Improvements was voted upon and approved, with but two dissenting votes, and the method was referred to the executive committee with power to act at the Wilmington convention of the older society.

## Practical Concrete Bridge Construction

*By Will Dickinson, Contractor, Ridgway, Pa.*

*Will Dickinson is a contractor who believes in good materials and good workmanship and a fair profit, and he is building his share of concrete bridges in competition with steel.*

In 1906, as closely as I could keep it from published statements of contracts let, the proportion of concrete bridges did not exceed 2 per cent., while in 1912 it was in the neighborhood of 40 per cent. The North Broad street bridge, opened

WILL DICKINSON, *Contractor, Ridgway, Pa.*

here in November (my No. 26), is 64-foot span, 35-foot roadway between curbs, two 7½-foot sidewalks, with balustrade rails,

No. 18. *Old and new Lockwood Run bridges. The concrete bridge cost* $500.

nine arch girders, with 5-foot rise. The structure has a total weight of some 1,350 tons.

I send a few photographs, with explanation as follows: No. 4, built in 1908, a small township bridge of 16-foot span, 18-foot roadway and 5-foot walk, near the boro line of Ridgway, showing my home on the knoll. This job was done at a fair profit for $550. (View not shown.)

Old and new of No. 18, a 12-foot span at a dangerous place in a deep ravine at foot of a heavy grade, built for $500, some fourteen miles from home.

Old and new of No. 12, three miles from Ridgway, on Elk creek; 92-foot span, 16-foot roadway between balustrade rails; price, $5,300. Photographs taken just three months apart.

No. 12. *Old and new bridges over Elk Creek, near Ridgway, Pa. Concrete bridge cost* $5,300.

## Advisory Good Roads Commission of the State of New York

Governor Sulzer, of New York, has appointed the following gentlemen as a special commission, to serve without compensation, for the purpose of collating facts and making such recommendations to the Governor as may seem fitting, with regard to the construction and maintenance of roads and the proper administration of the department of highways: James E. Gaffney, chairman, New York City; Geo. H. McGuire, secretary, Syracuse; Chas. E. Treman, Ithaca; Edward H. Butler, Buffalo; Col. William D. H. Washington, New York City; Prof. A. H. Blanchard, New York City; Paul L. Schultze, Troy; William Pierrepont White, Utica; Eugene W. Stern, New York City; John F. McDonald, Niagara Falls; Henry C. McCord, Merrick; Arthur A. McLean, Newburg; John J. Hopper, New York City; Gen. Amasa J. Parker, Albany; Augustus Thomas, New York City.

## South Park Playground Director

The Chicago South Park commissioners have secured John R. Richards as director of their playground system. He succeeds Edward B. DeGroot, who has built up the playgrounds to their present state of efficiency, and has given them the reputation of being the best in the world. His selection of instructors, preparation of athletic and social programs and general management have been thoroly efficient and have made him a leader in the playground development of the country. It has not been easy to fill the place left by his resignation.

Mr. Richards is well qualified in athletic work. He began as a fullback on the Wisconsin University team and has been coach for a number of football and baseball teams, the most recent being Wisconsin and Ohio State Universities.

## Albert Mohr

Albert Mohr, vice president of John Mohr & Sons, boilermakers, has been appointed a member of the Chicago South Park Board by the Circuit Court judges.

He will succeed Henry C. Foreman, whose term has expired and who resigned.

Mr. Mohr has been interested for the last thirty years in the small parks and playgrounds in the Calumet regions.

"We selected him," said Judge Adelor J. Petit, "because we know he has a kind heart, and that he is always planning something for the youngsters. He was ever trying to convert vacant lots into playgrounds, and it was surprising to see how he has succeeded."

## Civil Service Examinations

The United States Civil Service Commission will hold examinations at the usual places as follows:

April 16, 17: Mechanical engineering inspector in quartermaster's corps of the army at $1,200 to $1,500 a year; junior engineer in water resources branch of Geological Survey at $1,080 to $1,200 a year.

## Technical Associations

At the meeting of the Municipal Engineers of the city of New York, March 26, Foster Crowell presented an illustrated paper on the highways of America. On March 29, the society inspected the new subway construction, including the Chambers street station of the Brooklyn loop lines and the City Hall station of the Broadway subway. On March 15, the city tunnel of the Catskill aqueduct, was inspected.

The next meeting of the American Water Works Association will be held at Minneapolis, June 23 to 26. A special train will leave Chicago by the C. & N. W. R. R. Sunday evening, June 22, for convention attendants.

A housing exhibition is being held in the fourth, fifth and sixth floors of the City Club of Chicago by the club's committee on housing conditions, being open from March 17 to June 15. Dinner discussions were arranged for nine days in March and April. The prize competition plans for improving a typical flat quarter section of Chicago suburb are on exhibition.

The American Society of Engineer Draftsmen has moved its offices to 74 Cortland street, New York, to have room for its rapid growth. The society has a branch at St. Louis and one in Boston is just forming.

The fifth national conference on city planning will be held at Chicago, May 5, 6 and 7, with papers by such experts in the various phases of the subject as Frederick Law Olmstead, Virgil G. Bogue, George E. Kessler, E. H. Bennett, Milo K. Maltbie, on the technical planning and construction work; Edward M. Bassett, Charles H. Walker, William A. Magee, Dr. Werner Hegemann, on the executive, legislative and social features.

## Technical Schools

Among recent lecturers before the graduate students in highway engineering at Columbia University, New York, were William H. Connell, chief of the bureau of highways and street cleaning, Philadelphia, Pa., on "Organization of Municipal Highway Departments;" John R. Rablin, chief engineer Massachusetts Metropolitan park commission, Boston, Mass., on "Metropolitan Park Systems;" John A. Bensel, New York state engineer, on "Interrelationship of Highways, Waterways and Railways;" Nelson P. Lewis, chief engineer of Board of Estimates and Apportionment of New York, on "Methods of Paying for the Construction of Street Pavements;" A. W. Dow, chemical and consulting paving engineer, New York, on "Manufacture of Wood Paving Blocks."

## Personal Notes

DeWitt V. Moore, member American Society Engineering Contractors, has opened offices in the Merchants Bank Building, Indianapolis, as consulting engineer and architect.

Myron H. West, city planner, Chicago, has been employed by the city plan committee of the Chamber of Commerce of San Antonio, Tex., and will spend about a year in developing a plan for the future improvement of that city. Mr. West made a preliminary report early in March, covering all the items in the regular development of the city on which improvement is possible. The contract is contingent only on the failure of the people to vote for a bond issue to make improvements which are immediately necessary.

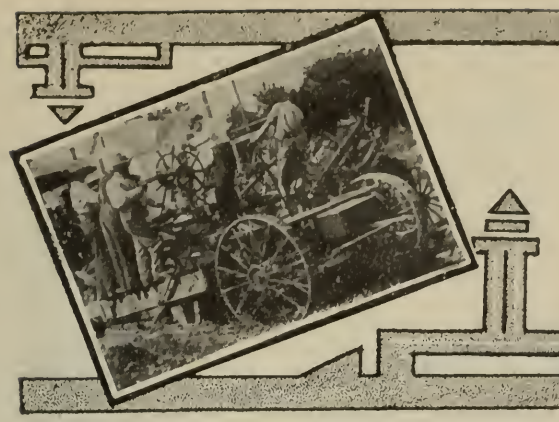
A. W. E. Fawkes has been appointed engineer in charge of water works at Calgary, Alta.

Lloyd McEntyre has been appointed bridge engineer of the New Jersey State Road Commission.

M. H. Baker has been appointed city engineer of Prince Albert, Sask.

William N. Ashplant has been appointed city engineer of London, Ont.

C. G. Elliott, member American Society Civil Engineers, former chief of the United States Bureau of Drainage Investigations, and A. D. Morehouse, assistant engineer, were reinstated in their positions by the last official act of ex-Secretary of Agriculture Wilson, thus fully vindicating these gentlemen of the charges made against them, which have been believed false from the beginning by those who know them.



# MACHINERY AND SUPPLIES

## Municipal Plants in Small Towns

The internal combustion engine, using a low-grade of oil, has made it possible for the small municipality to install light and water systems, and the majority of these plants are on a paying basis.

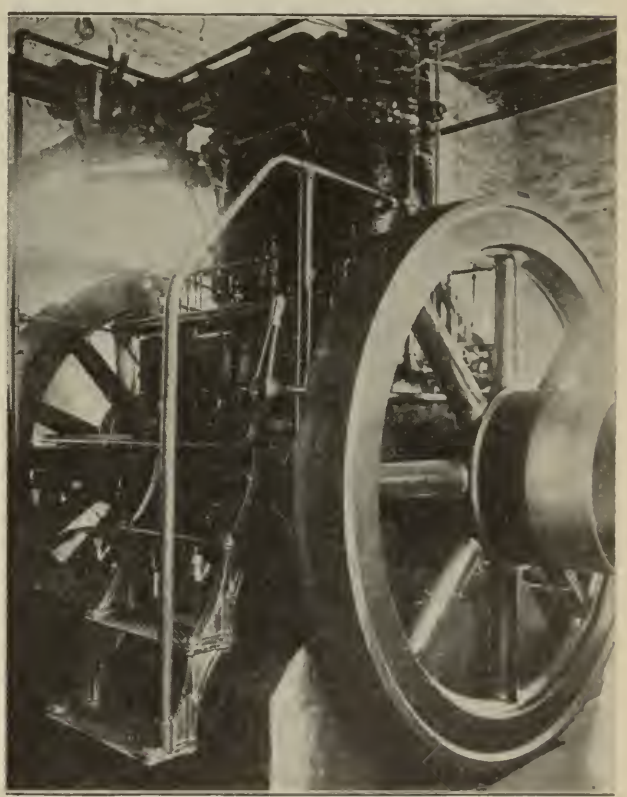
The city of Lucas, Kas., with less than 500 inhabitants, proves the above statement. Following is the report of the water and light plant of this city for the month of July, second month of operation, as furnished by H. H. Ingram:

| | |
|---|---|
| Water rents collected | $ 81.47 |
| Light rents collected | 116.65 |
| Total for July | $198.12 |
| Cost of operation | $ 32.82 |
| Fuel | 3.00 |
| Lubricating oil | 1.45 |
| Merchandise | 60.00 |
| Total | $ 97.27 |
| Profit for July | $100.85 |

The above report does not include the current furnished the city of Lucas and used for the operation of forty-five 80-watt series street lamps. Had the plant charged the city for these lamps at the rate of $1.00 per month, it would have been shown a net profit of $145.85. This plant is furnished with a 50-h. p. Fairbanks-Morse oil engine.

The city of Osawatomie, Kas., has quite recently erected a light plant, equipping same with two 80-h. p. Fairbanks-Morse oil engines of the R. E. type. The generators, which are direct connected to the engines, were also furnished by Fairbanks, Morse & Co. The high potential lines carry a voltage of 2,300. This is transformed down to 220 and 110 for commercial purposes and 1,100 for the lighting circuit. At present the motor service is very light and until the use of high-power motors demands a change, the motors will be furnished current from the lighting circuit. This necessitates the use of single-phase motors until the motor load should increase to such proportion that the motor load would interfere with the lighting circuit, when it would be necessary to erect a separate circuit for motors only.

The city of Downs, Kas., installed its plant in 1895, equipping same with a 20-h. p. Fairbanks-Morse combined gas engine and pump. This plant has been in operation every day since its installation and its up-keep costs are said to be



COMBINED GAS *engine and pump, Fairbanks-Morse, installed for city of Downs, Kas.*

exceptionally low in spite of the fact that the cost of operation upon gasoline is high compared to the cost of operation upon oil. The estimated cost of operation of this plant per 1,000 gallons, however, is but 8 cents, and this estimate covers engineer's salary, fuel, repairs, etc. This plant paid for itself in a remarkable short time.

THE FREEMAN *revolving see-saw.*

## Playground Apparatus

The piece of playground apparatus shown in the accompanying cut is a great attraction for the little folks. It has a revolving motion as well as the up-and-down of the see-saw, cannot upset and so is perfectly safe. The action is enlivened by the coil springs which are seen in the picture. The machine weighs 90 pounds, and when its 12 parts are securely packed the box, 9x14 inches and 5 feet 2 inches long, weighs about 125 pounds. The full size of the machine is 11 feet 8 inches long and 30 inches high. Nine bolts are used in assembling it.

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## Resurfacing Old Pavements

We have had considerable experience in the work of resurfacing and repairing old asphalt pavements and there is no question in our mind but that the surface heating method is the most economical and satisfactory.

We have a contract with the city of St. Louis, for repairing certain asphalt streets, aggregating about 140,000 square yards. When we started this contract we took up the old pavement and relaid it entirely with new material, but after the Lutz surface heater had been brought to our attention we discontinued that manner of making repairs and adopted the surface heating method, which was highly approved by the city authorities and we believe that we did more satisfactory work. The streets on which the Lutz surface heater was used are holding up splendidly and several of them have been done over three years.

It has long been a matter of common observance, that, when old methods are pursued, an opening repaired is never as good as the original undisturbed pavement, but the surface heating method enables these repairs to be satisfactorily made at a minimum expense and in such a manner that the place repaired cannot be detected, as no hummocks or depressions are left in the pavement. The constant pounding of traffic accentuates a more or less endless chain of repairs in every spot where there is the slightest raise or depression, and for this reason it is our opinion that the surface heating method will gradually gain in favor thruout the country.

City pavements are frequently cut into and it is stated that the useful life of a pavement is decreased fully 25 per cent. by these cuts and you may depend on it that just as long as electric ducts, telephone conduits, water mains, gas mains and sewers are beneath the streets just so long will street pavements continue to be opened up.

We have already repaired 40,000 square yards of asphalt pavement with the Lutz surface heater. New hot material does not weld or vulcanize onto old, cold pavements, even though painted with hot liquid asphalt. There being no union between the old and new material, cracks open up, admitting destructive elements, causing decomposition to set in.

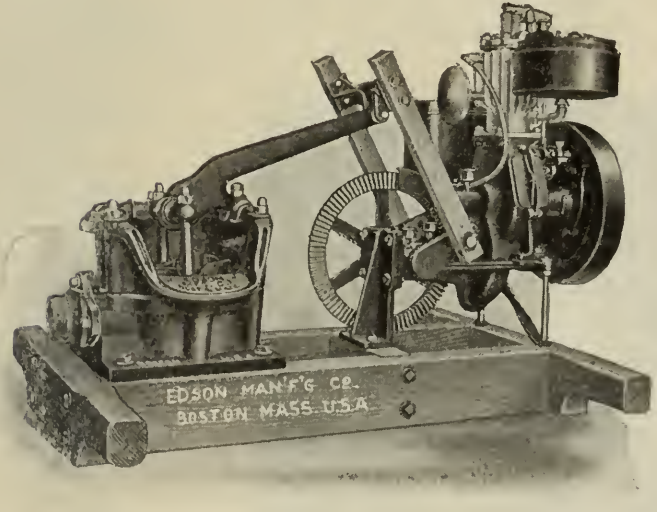
The Lutz method consists in drawing a large volume of air, heated to the proper temperature, from a heating chamber and blowing it with great force upon the asphalt or other bituminous pavement, thereby gently heating and softening without flame the old pavement to the same consistency as the new material. Then with the use of hoe and rake all disintegrated materials, uneven or worn surfaces are removed and joints

cut, and while the pavement is still hot sufficient new material to bring up the grade and contour of the street is added. The temperature of both materials being at the vulcanizing point, when tamped, smoothed and rolled a perfect weld is produced, leaving a finished surface. Instead of having a "patch," the repair becomes a part of the whole.

## Gasoline Diaphragm Pumps

One of the most convenient, time and money-saving bits of apparatus the contractor can find is the gasoline power diaphragm pump outfit. A very efficient combination is manufactured by the Edson Mfg. Co., 285 Atlantic avenue, Boston, Mass.

The writer has seen the outfit at work on sewer trench and is qualified to confirm the claims of the makers of completeness, value and economy. In emergency cases in the sewer and water departments of the city or in wet trenches and foundations in the course of the contractor's

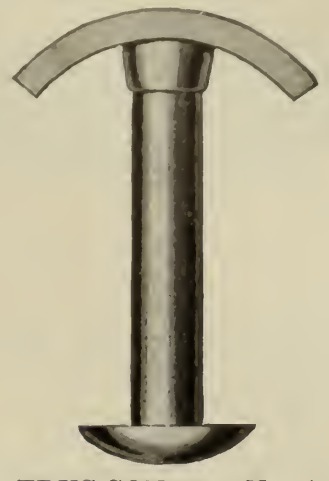



GASOLINE ENGINE *and diaphragm pump. Edson Mfg. Co.*

work they are invaluable. They are so easily set and moved and are so positive and reliable in their action that they are ready at any moment for any duty within their lift of 22 to 24 feet with plenty of reserve power beyond this required duty.

## The Trus-Con Curb Bar

Recognizing the demand for a concrete edge protector that could be manufactured and placed on the market at a reasonable cost, the Trussed Concrete Steel Company of Detroit, Mich., evolved the Trus-Con curb bar. They claim for this bar an economical arrangement of every particle of steel used to protect concrete curbs, shipping platforms, step nosings, entrance and interior columns, or, in short, any

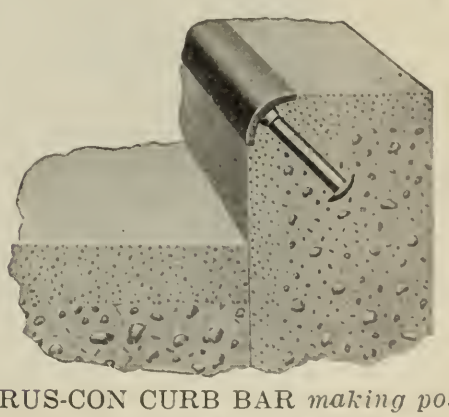


TRUS-CON *Bar No.* 1.

concrete edges exposed to strain incident to moving bodies, or as in curbs, to the added strain of temperature.

The Trus-Con curb bar No. 1 consists of two pieces of highest grade open-hearth steel, securely welded together, hot galvanized after forming. Plate ¼ inch thick, with periphery of 2½ inches. Anchor bolt 7/16 inch diameter and 4 inches long.

The Kahn System of reinforcing and finishing concrete in practically all of it thousands of applications, is extensively known, and is represented by offices in practically every large city on the globe.



TRUS-CON CURB BAR *making possible the efficient concrete curb.*

The Trus-Con curb bar is one of the Kahn System products and the manufacturers submit the following reasons as claims of superiority for the engineer's consideration:

The very best possible arrangement of a minimum amount of steel to secure most satisfactory results.

The very best grade of steel for the purpose, heavily galvanized, and anchorage to the concrete that is absolute, and one that becomes an actual reinforcement in addition.

TRUS-CON CURB BAR *adapted for curved curbs at street intersections.*

Simplicity of installation, as no special tools or detached parts are required.

Ability to distribute shock thruout the whole body of concrete.

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## Twenty-Five Ton Incinerator

*By B. F. Miller, Jr., City Engineer, Meadville, Pa.*

This city has been disposing of dead animals, rubbish, paper and waste from residences, hotels and restaurants since the year 1903 by means of an incinerator erected by the city at that time. This plant has a capacity of twenty-five tons per day and same is reduced to an odorless ash. Mostly all of this ash is dumped, although we do sell a considerable portion each month. All materials are collected tri-weekly by city wagons. These wagons drive direct from the roadway on to a steel platform and dump directly into steel hoppers directly over the incinerator proper. Our plant is built according to the patents of the Dixon Engineering and Construction Company, Toledo, Ohio, and is housed in a brick building. The initial cost of this plant was $8,232 exclusive of the lot, but is built in units and can be enlarged at any time.

INCINERATION PLANT *at Meadville, Pa. Note ideal location for unloading.*

During the period from January 1, 1911, to April 1, 1912, 2,294 tons of garbage were delivered at the incinerator. The total cost of operation, including labor, fuel and repairs, was 61½ cents per ton. Our coal costs us on an average of $2.65 delivered at the incinerator.

This incinerator plant is giving us very excellent satisfaction and the following is a report for the year ending Dec. 31, 1909:

FIVE UNITS *of Dixon Incineration Plant at Meadville, Pa.*

| | No. loads refuse | Dogs | Horses |
|---|---|---|---|
| January | 132 | 1 | .... |
| February | 125 | 1 | .... |
| March | 181 | 2 | .... |
| April | 180 | 3 | .... |
| May | 165 | .. | .... |
| June | 161 | .. | .... |
| July | 179 | 3 | .... |
| August | 177 | .. | .... |
| September | 167 | 3 | .... |
| October | 153 | .. | .... |

| | | | |
|---|---|---|---|
| November | 144 | .. | .... |
| December | 139 | .. | .... |
| Total | 1,903 | 13 | .... |
| Total cost of fuel | | | $ 404.29 |
| Total cost of labor | | | 614.00 |
| Total cost of operation | | | $1,018.29 |

Making an average rate of $.535 per load.
Salary of operator, $2.00 per day.

Most cities make the frequent mistake of trying to realize too heavily on the disposition of their garbage and other waste whereas the first consideration of any municipality should be the disposal of this waste in the most sanitary and speedy manner regardless either of the value of the waste or the cost of the disposal. We believe that our method of incinerating our waste material is most effective from a sanitary view point as well as being exceedingly economical. The initial expense is, of course, always the greatest, but when a municipality installs an effective system, the upkeep and maintenance cost is so small that the total cost per ton for any number of years is infinitesimal.

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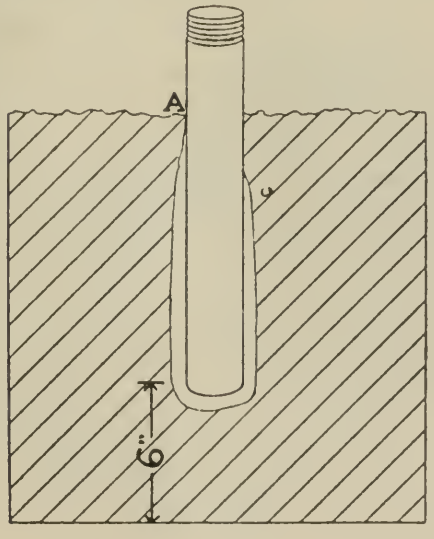
## Waterproofing Concrete Test

*By Robert W. Hunt & Co., Engineers, Chicago*

The following is a report of our "constancy of volume" test of a pat of neat cement made with water to which one-twelfth part of Ceresit had been added: This pat was made about 3 inches in diameter, ½ inch thick at the center and tapering to a thin edge as called for in the specifications of the American Society for Testing Materials. This pat was kept in moist air for a period of 24 hours and then subjected to an atmosphere of steam above boiling water in a loosely closed vessel for a period of 5 hours. The pat remained firm and hard and showed no signs of distortion, checking, cracking or disintegration.




The following is a report of our construction and tests of a concrete cube made with ceresit:

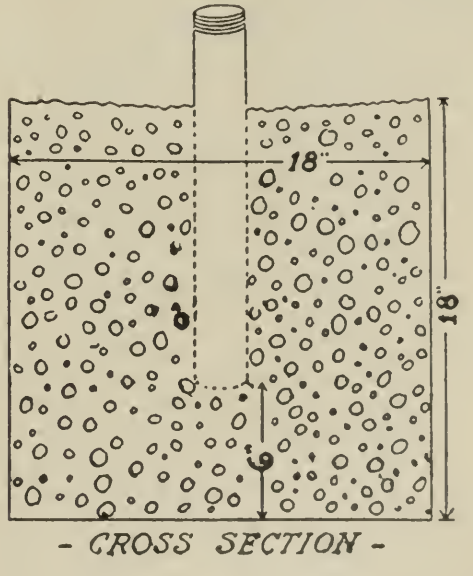
### Construction of Cube

Under date of November 10th, we constructed a cube of concrete with a 2-inch pipe embedded in it as indicated in the sketch accompanying.

This cube was made from a mixture of one part Universal cement to two parts of torpedo sand to four parts of clean gravel, ranging in sizes from 1 in. to ⅛ in. In the mixing of this concrete the amount of water used was approximately 13 per cent of the total volume of cement, sand and gravel. To this water had been added a proportion of Ceresit equivalent to 13.75 lbs. to the cu. yd. of finished concrete.

### Test of Cube

After aging 28 days in air a water pressure of 18 to 19 lbs. per square inch was applied in the pipe for a continuous period of 15 days. When this pressure had been applied about 2½ hours, the water commenced to seep up through the concrete at the location A in the sketch




accompanying. This was due to the water backing up along the pipe at the junction of the pipe and the concrete. This leak stopped within 15 hours after it first showed and there was no sign of any subsequent leakage until the date of December 28.

On December 28 the pressure of the water in the pipe was increased to 100 lbs. per sq. in. and held there for twenty minutes without any sign of leakage. The pressure was then increased to 190 lbs. per sq. in. and held there for a period of

15 minutes, during which the water seeped to the top of the cube at the location A in the sketch. This seepage continued through the balance of the test.

The pressure was then increased to 370 lbs. per sq. in. and held for five minutes without any apparently greater seepage. It was then increased to 460 lbs. per sq. in. and held for five minutes with the same results. At no other location on the cube was there any seepage whatsoever, and it is significant that at the bottom of the cube, or the end opposite the open end of the pipe, and the sides of the cube, there was no dampness at all.

Upon the completion of these tests the 18-in. cube of concrete was split open when a careful examination of the broken cube showed permeation of water as indicated in the sketch accompanying.

It was then observed that in the setting of the pipe in the concrete the cement had flushed up into the pipe a distance of 1¾ ins. from the open end of the pipe.

It was apparent from a consideration of the direction of the seepage that said seepage backed up toward the top of the cube as a result, first, of the insufficient bond between the pipe and the concrete, and, second, for the reason that the concrete toward the top of the cube was less dense than that at the bottom.

Below is a complete report of tensile tests on briquettes made:

Universal Cement

| 7 day Neat | 28 day Neat |
|---|---|
| No. 1—590 | No. 6—852 |
| No. 2—720 | No. 7—875 |
| No. 3—745 | No. 8—860 |
| No. 4—640 | No. 9—940 |
| No. 5—670 | No. 10—940 |

Universal Cement with Ceresit

| 7 day Neat | 28 day Neat |
|---|---|
| No. 11—705 | No. 16—848 |
| No. 12—630 | No. 17—827 |
| No. 13—670 | No. 18—850 |
| No. 14—575 | No. 19—705 |
| No. 15—565 | No. 20—748 |

Universal Cement, Ottawa Sand

| 7 day 1-3 | 28 day 1-3 |
|---|---|
| No. 21—265 | No. 26—350 |
| No. 22—250 | No. 27—355 |
| No. 23—260 | No. 28—393 |
| No. 24—290 | No. 29—350 |
| No. 25—285 | No. 30—394 |

Universal Cement and Ottawa Sand with Ceresit

| 7 day 1-3 | 28 day 1-3 |
|---|---|
| No. 31—290 | No. 36—383 |
| No. 32—285 | No. 37—307 |
| No. 33—295 | No. 38—395 |
| No. 34—290 | No. 39—345 |
| No. 35—290 | No. 40—347 |

Twenty-one per cent water used on all neat briquettes.

Ten per cent water used on all 1-3 briquettes.

On Ceresit briquettes water used made up of 1 part Ceresit to 12 parts of water.

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## Universal Pumping Engine

*By R. S. Adams, Chief Engineer Fire Dept., Petaluma, Cal.*

We have in operation a universal combination motor pumping engine built by the Nott Fire Engine Company of Minneapolis, Minn. Two men are required to operate the engine and their salaries are $75.00 to $85.00 per month.

The wheels of this engine are made after a special design and are known as the artillery type. Each spoke is 3 ins. in diameter. The front wheels have 16 spokes and the rear wheels 18 spokes. These wheels are equipped with solid rubber tires of the very best make—42 ins. by 5 ins.

The special transmission is worthy of consideration, and we understand the cost of same is exceedingly high as compared with transmission of an ordinary engine. This engine delivers 600 gallons per minutes against 140 lb. pump pressure.

The almost total elimination of wear and tear to the apparatus through exercising is also of great importance. Horse-drawn apparatus has to go the rounds every day to keep the horses in shape, while the auto apparatus is simply "turned over" for a very short space of time, three times a day, to see if it is in working order.

The motor propelled pumping engine can be set at a hydrant and be pumping the water much quicker than the steamer as the engineer and his assistant can both give their undivided attention to the work of coupling the suction. In case of a fire close to the station, the motor propelled engine can be coupled to a hydrant and be pumping as soon as connections are made. There is no wait as in the case of the steamer, as the response to the shifting of the power to the pump is instantaneous and the speed and pressure can be maintained indefinitely without variation.

No comparison can be made in the matter of running expenses as between motor propelled pumping engines and horse-drawn apparatus, as expenditure for the former is almost at a standstill until a response to an alarm is made. On the other hand, the expense of maintaining a horse-drawn steamer is constant on account of the heater, horse feed, shoeing and wear and tear repairs in general.

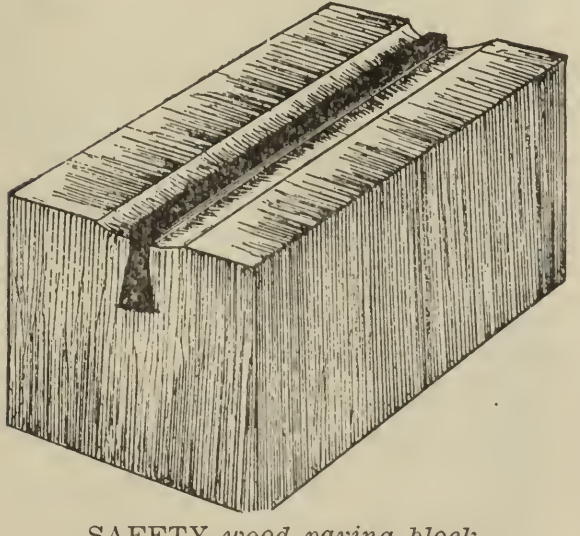
Again with motor propelled pumping engines sufficient fuel in the way of gasoline is carried for at least five hours' work, whereas with a steamer after working fifteen minutes fuel would have to be sent for.

It is my judgment and belief that a motor pumping engine, which is intended to take the place of the well-known and reliable steam fire engine, for fighting fires, will eventually be designed and perfected for the purpose. I do not believe it is possible for a gasoline fire engine to be successful unless all the parts are designed for the purpose by companies who know the requirements of a steam fire engine.

It is essential that all the working parts and construction of the engine must be in keeping with well known, durable construction of the steam fire engine. It is my belief that it is not the going to and coming from a fire that will lower the efficiency of the motor pumping engines, but it is the work that the engine is called upon to do when it is performing its duty in delivering its capacity with sufficient pump pressure to give a good fire stream when using from 300 ft. of hose in a line to as high as 1,000 ft. It is this constant horse power applied to the reciprocating parts of the engine and the pump that in my opinion makes it necessary to have the engine properly designed and constructed for the fire department use.

## To Overcome Slipperiness in Wood Block Pavements

The insertion of a bar of steel in a groove at the bottom of a channel in the surface of a creosoted wood block is the basis of the patent on a safety wood block made by the National Safety Wood Paving Company, 1522 Real Estate Trust Building, Philadelphia, Pa. The channel is 2 inches wide and ⅜ inch deep, and in the center is cut a groove to hold the steel bar or grid, which is 1 inch deep, ¼ inch thick at its top edge and ½ inch at the bottom, thus locking into the block, as shown in the accompanying cut.



SAFETY *wood paving block.*

About half the blocks in a pavement are fitted with the grids and the combination of channel and grid gives the horse a chance for a footing, which is a great help in drawing heavy loads. Skidding of automobiles is also prevented in large measure. The grid blocks may be laid in several patterns. Probably the most popular will be with every other block a safety block, or every other row composed of safety blocks entirely.

The price of the blocks is not prohibitive. Full information will be furnished by the company.

## Contractors' Grading Engine

The Reeves 25-h. p. simple double-cylinder contractors' grading machine is well-known among earth-moving contractors, as it is very extensively used for hauling, plowing and pulling elevating graders. The investment in such an engine is no greater than for the necessary number of mules, harness, feed and care, and more and harder work can be accomplished. The animals needed for hauling the grader can be used on dump wagons. More dump wagons mean more effective operation of the grader, less waiting and more yards of earth moved daily. Waiting for wagons is where a large part of the contractors' profit is dissipated.

The distinguishing feature of the Reeves' contractors' grading engine is the two simple cylinders with pistons connected to the same crank shaft, but at different angles. This prevents the engine from ever stopping on a "dead center" and the consequent provision of a heavy fly-wheel, found on single-cylinder engines, to carry it over center, and a clumsy clutch engaging with it to transmit power to the traction gear. The Reeves' simple double-cylinder engine will always start slowly, moving its load in the right direction, just as a railroad locomotive does. On the clutch-type of traction engine the fly-wheel must be running at full speed, generally 250 revolutions per minute, before the power can be applied to the traction gear. When this high speed is applied to the inert gearing, the engine starts ahead with a jump, often stripping cogs and breaking the coupling to grader.

As the nature of the work requires starting and stopping of the engine almost continuously all day long, it is easy to understand why the easy-motion Reeves meets the requirements so per-

REEVES *simple double-cylinder contractor's engine and elevating grader in a narrow, deep cut. A grader drawn by the usual number of teams could not be worked here to advantage.*

fectly with no expense for breakage and delay.

To afford close control of the engine the throttle is opened and closed by an overhead rod connecting with a bar supported by the cab posts. This bar has a long lever attached to either end so the throttle can be opened or closed from either side of the platform. This is a very desirable feature of a grading engine.

This engine has an exceedingly wide curving canopy cab extending over the entire platform while the sides are curved down to protect the operator from killing sunlight.

D. H. Blattner, a large contractor located at Tonasket, Wash., states that he has used his engine as above described for hauling his 50-ton steam traction shovel a distance of 18 miles. "We use this engine," states Mr. Blattner, "for a great variety of purposes. It gives excellent satisfaction in drawing our graders. We have a large cook house and office building on wheels and we have pulled this edifice, together with our heavy grading engine and four loaded wagons, a distance of 14 miles in less than 5 hours. By means of this engine and our elevating grader, we have frequently loaded as many as 1,360 1½-yard dump wagons in 10 hours. We used 18 wagons on this job, and could have loaded more if the wagons could have been gotten to the machine faster."

Orman & Crook, Belle Fourche, S. D., state that they have used one of these engines for hauling 35 cu. yds. of gravel in a train of 5 wagons a distance of 6 miles, and over grades of 12 per cent. "When conditions are favorable," states this concern, "we make two round trips daily. We figure the weight of the gravel at 2,800 lbs. per cu. yd. In addition to the gravel train we used our engine on grading machines. We have also used one of these engines as a steam roller on dam embankments. We once pulled one of our 12-ton dinky locomotives from Belle Fourche to the dam site over the country, on the engine's own wheels, without any trouble whatever."

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## Mineral Rubber Pavements

*By C. L. Herron, City Engineer, City of Hillsdale, Michigan*

Broad street, Hillsdale, Mich., which is laid with Sarcolithic Mineral Rubber Paving, is subjected to general traffic and carries almost all the traffic from the lake to the city. It covers 8,850 square yards. and mixed in a stationary machine and drawn in small carts to place of laying. This pavement is as nearly dustless as a pavement can possibly be and requires little sprinkling. All that is needed is flushing for the removal of manure and droppings from wagons. It is sufficiently resilient and rubbery to deaden and muf-

fle the impact of hoofs and iron tires, as well as absorb jars to those in vehicles.

The elasticity and give of the semi-gritty surface does away with slipping, skidding or sliding, as well as furnishing a firm foothold for horses, whether wet or dry.

## Armored Division Joints

*By Owen McKay, C. E., Walkerville, Ont.*

There is no doubt in my mind but that improper expansion and contraction joints lessen the life of concrete pavements, inasmuch as the constant jar of heavy traffic and blows of hoofs against the unprotected edges of the expansion joints result in steadily increasing abrasion which eventually produces ruts.

We formerly made the expansion joint in concrete pavement by laying a ½-inch board, stiffened by a steel band top and bottom to prevent warping or bending, laying the concrete flush with the board on each side and when set removing the board and using it again at the next joint. These joints were placed 36 feet apart to come opposite the expansion joints in the curb, which are 6 feet apart. Before any public travel was allowed on the pavement the joints were filled with tar.

Two years ago we first used Baker steel plates 2½ inches by ¼ inch, with bars sheared out of the plates, with space between plates filled in with tar as before. We also laid No. 9 wire, 8-inch mesh, in the pavement just between the base and wearing surface from one expansion joint to the other. The No. 9 mesh wire was made in strips 4 feet wide by the width of the pavement with hooks and rods to fasten the pieces together.

In our first concrete pavement in Walkerville, which was laid in 1907, we found that the weakest part was at the joint, which rapidly wore away thru the action of heavy traffic. The temperature cracks between joints also caused trouble but not to the same extent as at the joints. In the latter part of 1912 we used three ply's of tarred felt paper between the steel plates at the joints instead of hot tar, which was more convenient.

When the pavement got uneven we laid a thin coat of hot Tarvite over it and covered with coarse sand or fine gravel, making a uniform even pavement. This keeps the pavement in good condition for about three years if carefully laid and at a cost of about 8 cents per square yard. My opinion is that this covering should be put on as soon as the new pavement is laid and before it has any public travel in order to protect the pavement for the first year or until the concrete has thoroly hardened.

The Baker armored joints, which we are now using, insure a true and even joint absolutely flush with the balance of the pavement. All of our expansion and contraction joints are now protected against abrasion by means of these 3/16-inch soft steel plates, 2½ inches wide, which, being provided with shear members, are tied securely to the concrete base and wearing surface. The steel is open hearth, low in carbon and sulphur, this insuring even wear with the general concrete surface. These soft steel plates are clamped to steel division plates which, when joined, conform to the crown of the street. After the pavement is finished, and before the concrete has taken its initial set, the division plates are removed, and the opening is covered with tar paper until filled with tarred felt paper. We have adopted this method with great success and will state that these protection plates are made by the R. D. Baker Co., Detroit, Mich.

## Vibrolithic

Vibrated concrete, according to R. C. Stubbs, its inventor, has vibration and pressure applied to it together, and the value of the product is said to be greatly increased in strength and evenness of texture, Mr. Stubbs claiming a gain of 30 per cent. easily, and 50 per cent. or more in many lean yet commercial mixtures. His explanation is that there is an increase in the density of the concrete without disturbance of the homogeneity of the mixture. When the process is applied to the construction of a concrete pavement the result is Vibrolithic.

Munger Place, Dallas, Tex., was laid with this pavement in 1910 by Mr. Stubbs. It is covered with one course of concrete, 5 inches thick, of 1:2:5.5 mixture, the stone being ½ to 1½ inches, mixed very wet in a batch mixer and delivered to place by chute. After leveling off with rakes, the surface was covered with 1 inch of ½ to 1-inch wet broken limestone. On this surface were laid 1-inch boards, flexible enough to follow the curvature. A motor supported on wide wheels and running at 1,000 revolutions a minute was run over the boards three times, the weight and vibration forcing the surface layer of stone into the mixture and producing a dense mass. This process, from water into mixer to end of vibration, requires about fifteen minutes. After each 50 feet of length of street was laid and vibrated, the transverse form was removed and the edge of the concrete was painted with bitumen, thus forming a contraction joint. No expansion joints were made. The pavement lay ten days under a quarter inch of sand before traffic was admitted. The cost was $1.25 a square yard.

PORT HURON *general purpose roller, hauling Port Huron spreading cars.*

PORT HURON *general purpose roller, driving rock crusher.*

## Road Constructing Machinery

*By A. N. Johnson, State Highway Commission, State of Illinois*

Some kinds of machinery that can be economically used in a larger unit cannot be economically used in a town on account of the fact that the depreciation of these tools during the long part of the year they are not in use will more than make up for the saving effected by their use during a short part of the year. For example, if a township had a number of small concrete culverts to construct, it might be economical to purchase and use a small concrete mixer. A small mixer which will save nearly $1.00 per cu. yd. of concrete placed may be purchased for $300 or $400, so that if 300 or 400 cu. yds. are to be used in one or two seasons a small mixer suitable for larger work would seldom be economical for a town to own. Likewise, if a town has a large mileage of macadam roads to be maintained, it might be worth while to have a power roller for use in maintaining the macadam roads. But if, on the other hand, a small mileage is to be taken care of, the work can be done with the ordinary small tools in a satisfactory manner, altho not as cheaply as by use of the roller.

Road building machinery should be purchased only after a thoro investigation, especially in regard to the liability of breakdown and the expense of up-keep. The expense of repairs on road building machinery is very small in comparison with the loss which is occasioned by the disorganization of working crews by breakdowns. In deciding upon the purchase of machinery too much weight should not be given to the item of first cost, as the more expensive machine, in first cost, may be a far cheaper machine to operate.

If the road materials are expensive when shipped into the township, it may be advisable to maintain a quarry and crushing plant, but if materials can be obtained on board cars in the town at a price of $1.00 to $1.25 per cu. yd., it will not ordinarily pay the township to maintain a crushing plant unless it is expected to use it continuously thruout the season. If a considerable amount of gravel or crushed stone roads are to be maintained, it would be advisable for the town to own and use special dumping wagons which could be drawn by the tractor and used for hauling material for these roads.

If the type of soil and general characteristics of the roads of the townships are such as to permit the use of a power leveler which can take the place of the drag to a large extent, then this machine will be economical to use. If, on the other hand, the soil is of such a nature that it

PORT HURON *general purpose roller, hauling two graders.*

PORT HURON *general purpose roller, hauling scraper.*

River Parkway, Cambridge, Mass.

# Cambridge's Experience With Tarvia

CAMBRIDGE, MASS., is another Tarvia town. Many of its roads have been built during the last five years with "Tarvia X" or treated with "Tarvia B." The streets of Cambridge carry an enormous automobile traffic and the problem of maintaining adequate road surfaces was a serious one.

During 1912 eight of the leading thoroughfares which had been built with "Tarvia X" received surface treatments with "Tarvia B" at a cost of 2¾c. per square yard.

The Superintendent of Streets of Cambridge reports: "This treatment not only preserves the surface of the road from raveling, but renders the street dustless to a large extent. It has been found to be the most economical way to care for tar-bound macadam."

In later years it will be found that additional annual treatments with "Tarvia B" will cost less each year. Westfield, N. J., for instance, found that roads which had been built with Tarvia, cost as little as 1¾c. per yard per year to maintain with "Tarvia B."

Towns which experiment with Tarvia get the habit, and in time settle down to its use as a matter of consistent policy. By this means they reduce their road costs and at the same time give greater satisfaction to the citizens.

Tarvia is a special combination of refined tars especially prepared for road use. It forms a tough, plastic matrix about the stone and prevents erosion and attrition. It is not a palliative, but a cure. It does not *suppress* dust so much as prevent the attrition which *creates* dust. Booklet on request.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland
Cincinnati Minneapolis Pittsburgh Seattle Corey, Ala.
The Paterson Mfg. Co., Ltd.—Montreal, Toronto, Winnipeg, Vancouver St John, N. B., Halifax, N. S.

TRADE B MARK

cannot be traveled by a tractor drawing a leveler at the time of the year when the leveler should be used, it will be necessary to resort to the use of the drag drawn by teams, and a power tractor, and the leveler would not be an economical piece of machinery for the town to maintain. On light clay and gumbo soils, a leveler can be used to good advantage.

There is no class of machinery used in road building in which there is so wide a difference in construction and design and first cost as in the steam rollers. I think that it is generally conceded by road builders, and it has been my own experience, that a double-cylinder steam road roller is better adapted for road construction than any other type. There is no class of road building machinery which has been so highly developed. The wide variation in first cost of the different steam rollers makes it very difficult for a contractor or town official to make up his mind which one ought to be purchased. There is almost as much difference in road rollers as there is in watches. You may purchase a watch for a dollar which is liable to keep good time for a year, and it is liable not to do so. You may purchase a watch which costs almost any price, and in every case you will probably get just what you pay for. As a general thing the higher the price up to a certain limit, the more dependable the watch is, and the same rule applies to road rollers. There is no road building machinery sold that I know of upon which an exorbitant profit is being made. In looking over a road roller with the view of purchasing, particular attention should be given to an investigation of the gearing and wheels. You can tell by the looks of the wheels and gears upon the machine which has been in use, whether or not that machine is going to do your work day in and day out as it ought to. A set of rear wheels should last, under ordinary service, at least ten years. I have wheels which have been in service fourteen years and are good, I think for one more. The gearing on steam rollers should be of steel and cut and fitted as nicely as in any high-class automobile construction. Gears should be closed so as to exclude dust.

During the year 1912, we constructed the following amount of experimental road work:

| *1912* | *Sq. Yds.* | *Cost.* |
|---|---|---|
| Waterbound macadam | 177,349 | $118,328.00 |
| Bituminous macadam | 121,589 | 98,393.00 |
| Concrete | 26,509 | 23,154.00 |
| Waterbound macadam resurfaced | 21,971 | 1,658.00 |
| Bituminous resurfacing | 44,892 | 12,226.00 |
| Bituminous resurfacing on old macadam | 33,674 | 4,418.00 |
| Brick pavement (Elgin) | 10,017 | 15,000.00 |

The cost of engineering, supervising and inspecting experimental roads in the State of Illinois from 1908 to January 1, 1913, was as follows:

| | |
|---|---|
| Cost of work constructed | $ 650,183.00 |
| Sq. yds. of road constructed | 1,055,501 |
| Cost of 1,055,501 sq. yds. road | $624,319.00 |
| Total cost of engineering, superintendence and inspection, including office expenses for all work | 87,466.00 |
| Less cost of engineering furnished on roads not built by the commission— 25 miles at $50.00 | $ 1,250.00 |
| Less cost of supervision of non-experimental roads using penitentiary stone | 1,335.00 |
| Total expenses not chargeable to experimental roads | $ 2,585.00 |
| Cost of engineering and supervision on experimental roads | $ 84,881.00 |
| Percentage of total cost of experimental roads expended for engineering, superintendence and inspection | 13% |
| Cost per sq. yd. finished road for engineering, supervision, and inspection | $0.059 |

## The Morse Destructor Furnace

Notice is hereby given that the business of contracting and construction of destructors and incinerators under my patents has been assumed by the Griscom-Russell Company, 90 West street, New York City, to whom all inquiries relating to this destructor should be addressed. No other person or company has any right or control of my patents or constructions in all the various forms designed or built by me.

W. F. Morse,
90 West Street, New York.

## Iroquois Iron Works Now the Barber Asphalt Paving Company

It is announced that hereafter the business of the Iroquois Iron Works, of Buffalo, N. Y., will be carried on under the name of the Barber Asphalt Paving Company. This, however, will involve no change in management or policy, and "Iroquois" will be retained as the trademark name of the Barber company's paving and road-making tools and machinery.

Some twenty years ago, when a large demand first arose for the machinery and tools necessary for asphalt paving, the Iroquois Iron Works were established and soon became known as the machinery department of the Barber company. In former years, when contracting was the most

# The SARCO Asphalt Case

***Culmer Patents Number 635429 and 635430***

## Decree of Hon. Christian C. Kohlsaat, United States Circuit Judge, Filed March 3, 1913, Sustaining above Culmer Patents on Process and Product and Holding them Valid and Infringed.

**Charles K. Offield,**
**Albert H. Graves,**
**F. L. Belknap,** *Of Counsel.*

**OFFIELD, TOWLE, GRAVES & OFFIELD,**
*Solicitors for Complainant.*

## UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF ILLINOIS

EASTERN DIVISION

STANDARD ASPHALT AND RUBBER COMPANY
Complainant

vs.

AMERICAN ASPHALTUM & RUBBER COMPANY, et al.
Defendant

IN EQUITY.
Bill for Infringement of Patents.

## DECREE

This cause came on to be heard upon final hearing on bill, answer, replication and proofs taken and filed herein on behalf of both parties, and was argued by counsel for the respective parties—Charles K. Offield and Albert H. Graves for complainant, and Edward Rector and Charles C. Bulkley for defendant; and thereupon after due proceedings had and the Court being fully advised, it is upon consideration—

ORDERED, ADJUDGED AND DECREED, as follows:

I.

That (1) Letters Patent of the United States, in complainant's bill of complaint sued upon, granted George F. Culmer and George C. K. Culmer, under date of October 24, 1899, for new and useful Improvements in Processes of Making Asphaltic Fluxes, No. 635,429, and (2) Letters Patent of the United States granted George F. Culmer and George C. K. Culmer, dated October 24, 1899, for new and useful Improvements in Asphaltic Fluxes, No. 635,430, are good and valid Letters Patent, respectively; and that said George F. Culmer and George C. K. Culmer were the *original and first inventors of the processes and improvements described and claimed* in said letters patent, respectively.

II.

That the complainant, Standard Asphalt & Rubber Company, is the lawful owner of, and entitled to, the exclusive right and title in and to said letters patent, and in and to the inventions and improvements respectively thereby secured.

III.

**That said defendant, American Asphaltum & Rubber Co., by reason of the practice of the process described and claimed in said Letters Patent No. 635,429, and the production of the product described and claimed in Letters Patent No. 635,430, and in complainant's bill of complaint set forth, has infringed the single claim, respectively, of each of said above letters patent—Nos. 635,429 and 635,430, and has violated the exclusive right of the said complainant thereunder.**

IV.

That the said complainant does recover of the defendant, the gains and profits made by it, and the damages sustained by complainant by reason of such infringement.

V.

That it is hereby referred to Charles B. Morrison as Master, to ascertain the amount of such gains and profits made by the defendant, American Asphaltum & Rubber Co., and the damages sustained by said complainant, by reason of such infringement, and that complainant, on such accounting, has the right to cause an examination of the officers of said defendant, American Asphaltum & Rubber Co., ore tenus, or otherwise, and also the production of the books, documents and vouchers of said defendant, and that said defendant attend for such purposes before said Master from time to time as said Master shall direct.

VI.

**That a writ of injunction, according to the prayer of said bill of complaint, be issued out of and under the seal of this Court, restraining and enjoining said defendant, American Asphaltum & Rubber Co., its officers, attorneys, agents, employes, servants, workingmen and all others acting by or under its authority, from any further infringement of said Letters Patent Nos. 635,429 and 635,430, respectively, and of the exclusive right of complainant, Standard Asphalt & Rubber Co., thereunder.**

VII.

That complainant, Standard Asphalt & Rubber Co., recover of the defendant, American Asphaltum & Rubber Co., its costs and disbursements of this suit, to be duly taxed, and that the question of increased damages be reserved until the coming in of the Master's report.

Dated at Chicago, Ill., March 3, 1913.

CHRISTIAN C. KOHLSAAT, Judge.

important division of the company's business, it was the largest user of rollers and paving apparatus in general. It could not buy from others the machinery and tools it required, and therefore made them for its own use, as well as for sale to others. In this way the Iroquois line developed as an embodiment of the requirements of the paving contractor and was constantly improved by the experience of the manufacturers as paving contractors. Iroquois rollers, both tandem and macadam, are now found the world over. The Iroquois output also includes heating kettles, surface heaters, mixers, and hand tools of every kind.

## Publications Received

Regulation, Valuation and Depreciation of Public Utilities, by Samuel S. Wyer, M. E., consulting engineer, Columbus, O. Leather, 313 pp., $5. Sears and Simpson Co., Columbus, O.

The Regulation of Municipal Utilities. Edited by Clyde Lyndon King, Ph. D. National Municipal League Series. Cloth, 404 pp., $1.50 net. D. Appleton & Co., New York and London.

Valuation of Public Utility Properties. By Henry Floy, M. A., M. E., consulting engineer, Mem. A. I. E. E., Am. Soc. C. E., Illum. Eng. Soc., N. Y. Elect. Soc., etc. Cloth, 390 pp., $5 net. McGraw-Hill Book Co., 239 W. 39th street, New York.

Valuation of Public Service Corporations; legal and economic phases of valuation for rate making and public purchases. By Robert H. Whitten. Cloth, 789 pp., $5.50. Banks Law Publishing Co., New York.

Engineering Valuation of Public Utilities and Factories. By Horatio A. Foster, consulting engineer, Mem. A. I. E. E., A. S. M. E. Cloth, 350 pp., $3 net. D. Van Nostrand Co., 25 Park Place, New York.

*Lefax* is a series of data sheets giving data on all engineering subjects, similar to *Data*, which was published for a short time in Chicago, which can be filed as desired. $1 a year, entitling subscriber to 100 data sheets and special terms for special subjects. Standard Corporation, Pennsylvania Building, Philadelphia, Pa. ference.

Manual for Engineers, issued by the University of Tennessee, 70th thousand. Leather, 50 cents. Knoxville, Tenn.

Auditing: Theory and Practice. By R. H. Montgomery, C. P. A., president Am. Ass'n of Pub. Accountants. Half leather, 700 pp., $5. The Ronald Press Co., 198 Broadway, New York.

Replanning Small Cities. Six typical studies by John Nolen, F. Am. Soc. Landscape Architects. Cloth, $2.50 net, 20 cents postage. B. W. Huebsch, 225 Fifth avenue, New York.

*The Isolated Plant* is a magazine devoted to private power and light plant installations.

The "Toxement" booklet for 1913 is issued, describing this waterproofing for cement construction.

The American Asphaltum and Rubber Company, Harvester building, Chicago, is circulating a booklet containing a description of the successful waterproofing of the Webb City (Mo.) concrete reservoir of 1,300,000 gallons capacity with Pioneer reservoir waterproofing asphalt.

Reducing coal consumption and increasing the efficiency of the power plant by using the Lea V-notch water-flow recorders is demonstrated in a booklet of the Yarnall-Waring Co., Philadelphia, Pa.

The Humboldt Mfg. Co., Chicago, issues a new price list of asphalt and cement testing laboratory apparatus under date of March, 1913.

*Graphite* is the house organ of the Joseph Dixon Crucible Co.

The Jewell Nursery Co., Lake City, Minn., issues a catalog of hardy trees and plants.

Miller flush tank siphons for shallow depths are the subject of Circular No. 8 of the Pacific Flush-Tank Co.

The Ruggles-Coles Engineering Co., New York, issue a circular on their road machines, including portable and semi-portable dryers, heaters, mixers and their combinations for various kinds of road and pavement construction.

## Trade Notes

The Northern Fire Apparatus Company of Minneapolis has recently reorganized the sales department of its business. G. P. Williamson has become identified as a member of the firm and will assume the active management of sales. Mr. Williamson is an experienced apparatus man and in addition has served an extended period in sales management. The Northern Company has always made a specialty of volunteer department apparatus, and the remarkable growth of its business has necessitated this addition to its management.

J. W. White, engineering salesman for the Jeffrey Mfg. Co., will hereafter look after the sales of the above company in eastern Minnesota, northern Wisconsin and the upper peninsula of Michigan, with headquarters at 1905 East Superior street, Duluth, Minn.

The Raymond Concrete Pile Co. of New York and Chicago have been awarded a contract for placing 2,047 standard Raymond concrete piles for the foundation of the new Rock Island elevator, Kansas City, Kas. The MacDonald Engineering Co., Chicago, are the general contractors.

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# MUNICIPAL ENGINEERING

**The World's Leading Municipal Publication.**

PLAYGROUND *and equipment, Oakland, Cal.*

VOL. XLIV. MAY, 1913. No. 5.

*Experience is one of the big assets which every man can place in his personal balance sheet. The successful man makes it show a profit. In these pages it is the endeavor of the publishers to give you of the experience of many men in your allied field of work and to thereby add something to your experience assets.*

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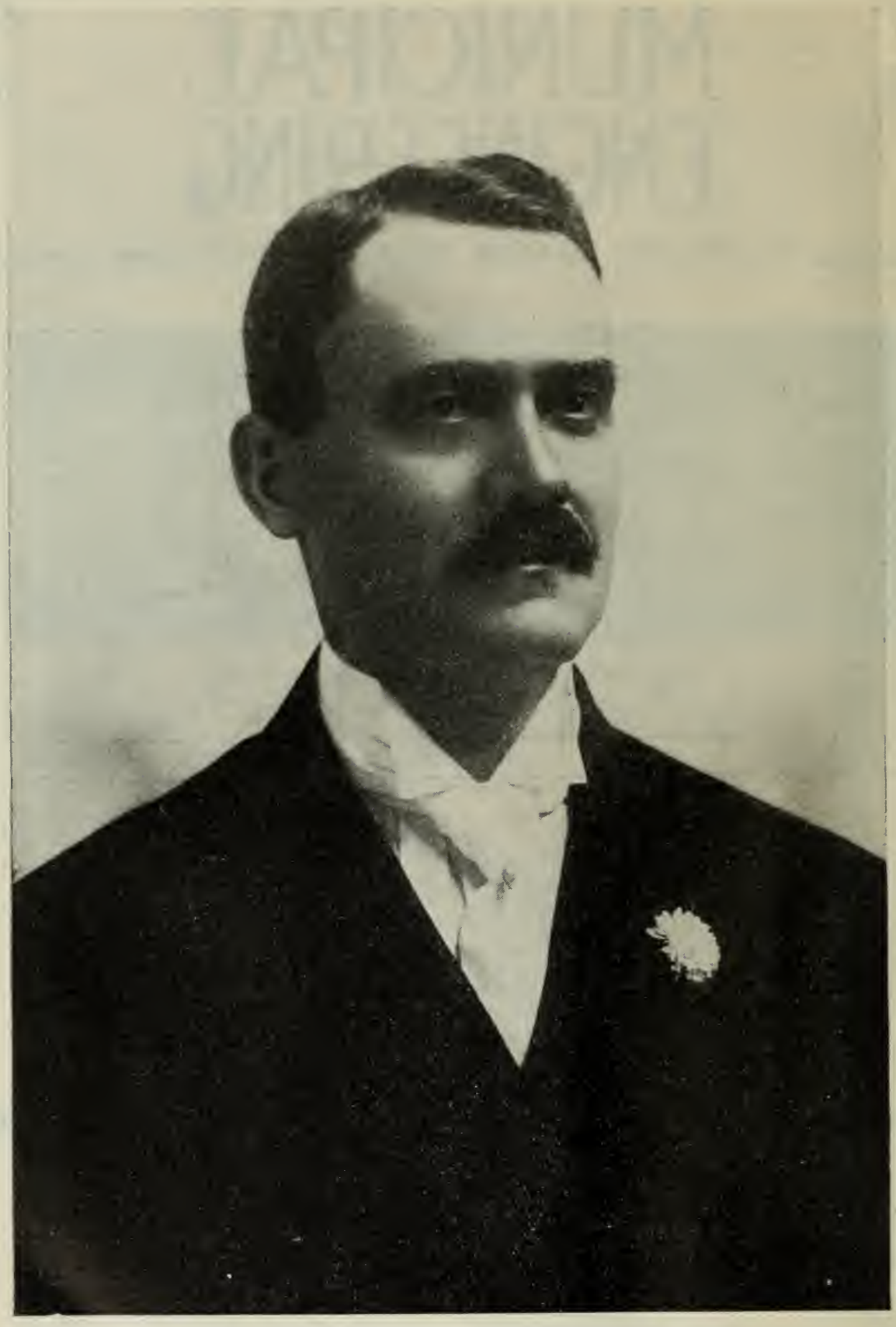


Photo by Klein, Milwaukee Wis.

F. G. SIMMONS.

(See "Men Prominent in Municipal Affairs.")

# COST OF ASPHALT REPAIRS

ASPHALT REPAIR PLANT *at Erie, Pa., designed by B. E. Briggs, City Engineer.*

SOME reports of the operation of municipal plants for the repair of streets for 1912 have been received and are abstracted in the following. Brooklyn accounts are kept in the utmost detail and the abstract below gives only the more noticeable items. The report from Erie is also quite full. Milwaukee uses the old material from the street and thus has quite a different report from any of the others. Winnipeg gives the totals without itemizing material, labor and overhead items. Others are held over for a following number.

A comparison of the figures from the various cities shows that they do not differ more than might be expected from the differences in cost of materials and labor.

### Borough of Brooklyn, New York

The city of Brooklyn owns an asphalt paving plant which was built in 1907 by the Warren Brothers Company and is worth at this date $37,326.06, with improvements added and depreciation of 10 per cent. deducted. While the work which this plant does is much larger in amount than in the case of Dayton, O., concerning which an article was published in the February number of MUNICIPAL ENGINEERING, vol. xliv, p. 127, it is probable that the greater expense of doing work in the larger city offsets the reduction in average cost on account of keeping the plant more constantly in operation.

By courtesy of H. H. Schmidt, chief engineer of the bureau of highways of the borough of Brooklyn, New York, we have received an advance copy of the report of the asphalt repair department for 1912, and the following figures are taken from that report.

The force at the plant includes two foremen, two engineers, two stokers, two laborers and twenty asphalt workers, a total of twenty-eight. The force on the street works in seven gangs, each with a foreman, an engineer, fifteen asphalt workers and three trucks, with one truck missing and two asphalt workers short. This makes a street force of 137 men, or a total of 165 men.

The law requires the payment of a minimum wage of $2.50 a day, so that the laborers and practically all the asphalt workers are paid at this rate. The equivalent of one asphalt worker for 283 days received $3, which was paid stokers also. Nearly half the foremen's time was paid for at $4, the remainder and that of the engineers at $4.50. The superintendent's salary was $2,874.99 and his automobile cost $2,286.68 for maintenance.

The report gives the expenditures in the utmost detail of items. Unit or average unit costs of the more important items were as follows:

Refined asphalt, average, $15.94 per ton.

Binder stone, $1.25 a cubic yard, with a little at $1.10.

Cement, $1.02 a barrel, with a little at $1.10 and $1.18.

Coal, $2.015 per ton, mine weight, with some ranging from $1.92 to $2.62.

Fuel oil, 5 cents a gallon.

Residuum oil, 7½ and 8 cents a gallon.

Sand, 63⅞ cents a cubic yard with some at 51½ and some at 67½ cents.

Stone dust, $2.95 a ton, with a little at $3.05.

The summary of expenditures shows items which have the following totals:

| | |
|---|---|
| Overhead, including superintendent's salary, depreciation, interest and rent | $ 11,490.96 |
| General, including fuel, oil, automobile maintenance, dumping privilege, repairs to the plant and equipment, rent of Lutz surface heater, and office | 26,168.74 |
| Asphalt materials, including refined asphalt, residuum oil, stone dust and sand | 48,792.98 |
| Asphalt, residuum and stone for binder | 8,517.05 |
| Concrete materials | 13.46 |
| Special work materials | 664.71 |
| Plant labor, including foremen | 17,668.72 |
| Street labor, including foremen | 81,939.44 |
| Trucking | 27,405.00 |
| Total expenditures | $222,661.06 |

For this sum the following work was done:

Regular maintenance:
Wearing surface, 210,240.63 cu. ft.
Binder, 64,352.43 cu. ft.
Special maintenance with surface heater:
Wearing surface, 71,763.45 cu. ft.
Binder, 1,852.50 cu. ft.
Restoring street surfaces:
Wearing surface, 82,304.82 cu. ft.
Binder, 29,013.57 cu. ft.
Only 187.8 square yards of concrete foundation were laid.

Maintenance costs are computed per cubic foot of mixture used, with separate figures for wearing surface and binder. Supervision and fixed charges are distributed over the whole volume and amount to 2.6 cents per cubic foot. Materials cost 13.4 cents for wearing surface and 9 cents for binder. Other items are classified as regular maintenance and special repair with Lutz surface heater. Supplies, repairs, etc., cost 4.9 cents and 9 cents, respectively; plant labor, 4 and 3 cents; street labor, 18 and 9 cents; trucking, 5.7 and 3.8 cents per cubic foot, respectively.

The total cost per cubic foot for regular maintenance was 48.6 cents for wearing surface and 44.2 cents for binder; for surface heater work it was 40.8 and 36.4 cents, respectively. The total cost per cubic foot for both kinds of maintenance combined was as follows:

MAINTENANCE COST.

| | Wearing surface cents cu. ft. | Binder cents cu. ft. |
|---|---|---|
| Supervision and fixed charges | 2.6 | 2.6 |
| Supplies, repairs, etc | 6.1 | 5.2 |
| Materials | 13.4 | 9.0 |
| Plant labor | 3.7 | 3.9 |
| Street labor | 15.7 | 17.7 |
| Trucking | 5.2 | 5.6 |
| Totals | 46.7 | 44.0 |

Taking into account the amounts of each used, the average cost of binder and wearing surface is 47.6 cents a cubic foot. These maintenance costs are subdivided in great detail as to each item in the report.

The cost of restoring openings made in street surfaces and repaving is analyzed separately. The total cost of restoring the 111,318.39 cubic feet of wearing surface and binder, above named, was $57,602.73. The costs per cubic foot itemized were as follows:

RESTORATION COST.

| | Wearing surface cents cu. ft. | Binder cents cu. ft. |
|---|---|---|
| Supervision and fixed charges | 2.4 | 2.4 |
| Supplies, repairs, etc | 4.9 | 4.9 |
| Materials | 13.4 | 9.0 |
| Plant labor | 4.0 | 4.0 |
| Street labor | 19.8 | 19.8 |
| Trucking | 8.1 | 8.1 |
| Totals | 52.6 | 48.2 |

These figures do not differ materially from those for maintenance cost, except that street labor and trucking are materially higher.

All the above figures are per cubic foot of material used. No statement is made of the area of repairs actually made, but the amount of pavement restored is given as 46,537.4 square yards. This makes the cost per square yard for restoring and repairing, $1.231, without concrete. Of this 93.1 cents is for wearing surface and 30 cents is for binder.

The thickness of repairs is not estimated. If we assume that the average

thickness of repairs is two inches, the assumption will not be unreasonable, for the thickness of new wearing surface is two inches, and the amount of binder used in repairs is more than one-fourth the amount of wearing surface material used.

On this assumption, the 47.6 cents per cubic foot average cost of binder and wearing surface is equivalent to 71.4 cents per square yard of asphalt actually laid in repairs. It checks reasonably well with the cost of restoration given above, $1.231, assuming the thickness of the binder to be 1½ inches.

An area of 21,857 square yards was resurfaced with skim coat by the Lutz heater and 38,394 square yards with the Iroquois heaters, a total of 60,251 square yards. The item of materials is 1½ to 3½ cents a yard higher than that for wearing surface in the tables above, but labor and trucking items are less. The total costs are for the Lutz heater, 53.7 cents a square yard, and for the Iroquois heaters, 47.4 cents a square yard. Deducting 10 cents a square yard charged for rental of the Lutz heater makes the cost of repairs with it 43.7 cents. The cost of all the work with both heaters averaged 49.6 cents a square yard, including the rental of the Lutz heater. The number of cubic feet of paving material laid was 73,616, so that the average thickness of the work was 1.62 inches, an indication that the assumption of 2 inches total thickness of regular maintenance is not far wrong.

Cost of repaving without foundation, done by contract, was 82 cents to 90.7 cents a square yard in 1910 and 1911.

MUNICIPAL ASPHALT PLANT *at Brooklyn, N. Y., built by Warren Bros. Company.*

**Erie, Pa.**

The city of Erie, Pa., Ben. E. Briggs, city engineer, has operated its new asphalt repair plant for about a year with excellent results. The plant cost $12,360 and 10 per cent. of this sum was charged to operating expenses for interest and depreciation. Labor and teaming cost $5,602.20, including foreman, and materials cost $7,495.73. Nothing is charged for city engineer's time. The city owns the asphalt wagons, but hires teams to haul them. It is claimed that a considerable saving could be made if the city owned a number of teams.

With this amount of material and labor a total of 21,476.34 square yards of top

and binder were laid, each 1.5 inches thick, or a total of 3 inches. This makes the average cost per square yard 68 cents, made up of the following items, divided as nearly as possible according to the Brooklyn plan:

| | Cents |
|---|---|
| Supervision, (0), fixed charges and repairs | 7.0 |
| Materials | 34.9 |
| Plant and street labor | 19.5 |
| Teaming | 6.6 |
| Total | 68.0 |

The total cost per square yard is slightly less that in Brooklyn, estimated above at 71.4 cents. The plant being new and no supervision being charged, these items are less. Labor and teaming are also less, days wages being less. But material, especially asphalt, cost more in Erie.

The following prices compared with those for Brooklyn show the detail.

Refined asphalt, $20.50 to $24 a ton.
Crushed stone, $62.50 a car.
Coal, $3.22 a ton.
Fuel oil, 3.9 cents a gallon.
Flux oil, 3.8 cents a gallon.
Sand, $31 a car.
Stone dust, $3 a ton.

The Erie plant did 4,161.88 yards of work for corporations and various city departments in repairing cuts in pavements, etc., for which it received $1 a square yard. Deducting this yardage and credit from the corresponding figures above, the actual cost to the plant of work done for the city is 60.3 cents a square yard.

### Milwaukee, Wis.

Frank W. Blodgett, superintendent of street construction, Milwaukee, Wis., reports as follows:

"We have in Milwaukee, one stationary repair plant which we are rebuilding this winter, and expect to output from this plant about 2,500 square yards of asphalt. We have also two portable repair plants, eah one with a capacity of about 125 square yards.

" These plants are designed to melt up the old material. This old material having been melted and freshened with a small amount of asphaltic cement, is then used for repairing purposes.

"The cost of repairs for the past year, which is the only year in which any record has been kept, averages about 85c per square yard. This includes the cost of new work, which was done at the price of about 26c per square yard. The same material was used in the laying of new pavements as was used in the repairing of old pavements.

"The small portable asphalt repair plants cost us $1,500.00 each. The large plant costs us originally $5,000.00, to which will have to be added the cost of rebuilding, which will amount to about $1,500.00. I desire to say, however, that if the stationary plant had been built in the first place as we are rebuilding it, the cost would probably not have exceeded $4,000.00; the rebuilding being made necessary by defective heating apparatus. As the plant originally was constructed it was practically impossible to turn out a batch of asphalt in less than forty-five (45) minutes.

"Our contracts for resurfacing old pavements with asphalt require that the old surface be delivered to us at our stationary plant by the contractors, which accounts in some measure for the low cost of the repair work.

"The material as remelted and placed upon the street is superior to the generality of new asphalt pavements and will last at least as long and probably longer than any of the pavements laid by contract.

"We are at the present time proposing to do away with the two small portable plants, providing the stationary plant delivers the material to the amount that we hope that it will do after we rebuild it, as we find we can mix the material at the stationary plant and haul it three miles and put it upon the street, cheaper than we can by the use of the two small portable plants."

### Winnipeg, Man.

C. S. Landon, superintendent of the asphalting department of the city of Winnipeg, Canada, makes the following report:

The cost per square yard of each kind of asphalt pavement laid includes the cost of material, unloading, insurance, etc., plant labor, street labor, the cost of

hauling, and the cost of fuel and does not include grading and concrete base.

In Winnipeg during the past few years it has been the custom to lay 4½ inches of concrete on residence streets, and 6 inches of concrete on business and other heavy traffic streets. It is the intention now, however, to lay not less than 6 inches on any street, the difference being made up by lessening the thickness of the binder and surface courses of residence streets.

It might be of interest to know that this city began laying its own pavements in the year 1899. During that time nine different brands of asphalts have been used at prices ranging from $40 a ton in the year 1899 to $21.65 per ton in the year that has just passed.

SUMMARY OF COSTS

Granite sheet asphalt, 1½ inch binder, 2 inch surface, $1.044 per sq. yd.

Standard sheet asphalt, 1½ inch binder, 2 inch surface, $0.981 per sq. yd.

Granite sheet asphalt, 1 inch binder, 1 inch surface, $0.677 per sq. yd.

Standard sheet asphalt, 1 inch binder, 1 inch surface, $0.644 per sq. yd.

Asphaltic concrete, 2 inch granite, $0.605 per sq. yd.

Bituminous concrete, 1 inch binder, 1 inch bit. con. granite, $0.561 per sq. yd.

Cross mixture, 1½ inch binder, ½ inch surface, $0.558 per sq. yd.

Asphaltic concrete, 2 inch limestone, $0.517 per sq. yd.

In the granite sheet asphalt a percentage of the aggregate is replaced by an equal amount of granite screenings ranging in fineness from ⅜ inch to dust.

The constituent parts of the cross mixture are identically the same as those in the standard sheet asphalt.

The concretes as shown differ but little in composition and where granite is cited it means that this kind of rock is used as a part instead of limestone.

The costs of materials during the year 1912 were.

| | |
|---|---|
| Limestone, crushed..... | $ 1.25 a cu. yard |
| Granite ..... | 3.50 a cu. yard |
| Sand (coarse and fine). | 1.10 a cu. yard |
| Limestone dust ..... | .65 a cu. yard |
| Asphalt ..... | 21.65 per ton |

# SAN MATEO COUNTY, CAL., HIGHWAYS

*By R. M. Morton, Chief Engineer.*

The system of roads outlined for San Mateo county contemplates fifty to sixty miles of roadway with concrete base and fifty miles of gravel or macadam. The latter type is to be used only in locations where natural material is available at low cost.

This system, together with the twenty miles of state highway, will give San Mateo county the best system of roads in the state. Surveyor Neuman has secured most of the forty miles of right of way necessary for the completion of the system contemplated under the bond issue.

We have planned all these roads for a maximum grade of 5 per cent. except on those where the travel is light and then the grade is a maximum of 6 per cent. This will be the only county in the state where such a system could possibly be constructed at the present time, for the reason that no other county is in such a financial condition as to be able to take care of all the main roads in the county.

The cheaper forms of material (gravel and macadam) have been subordinated, as they have been found not to pay except where the natural material can be found in sufficient quantities to maintain the roads at a low cost. Concrete with asphaltic surface is known to be the bost economical and permanent road, and these have been prescribed where conditions of traffic warrant.

# SEWER SIPHONS UNDER NEW YORK SUBWAY

*By Thad. L. Wilson, before the Brooklyn Engineers' Club.*

The building of subways necessitates material changes in the location of existing sewers along the line of the subway. Generally the sewers can be passed either above or below the subway structure by altering the general gradient of the sewer, or by rebuilding the sewer at a considerably lower level than before, either of which is a simple operation. It sometimes happens that the existing sewer has its invert elevation at or below high tide level and the subway structure lies in the same horizontal plane. Then, it being impracticable to raise the sewer, it is necessary to lower it, thus making a radical break in the original gradient and resulting in an inverted siphon.

To avoid these inverted siphons it would be necessary to make the subway the dividing line between drainage areas, or else to lower the subway sufficiently to allow the sewer to pass over the roof. To effect the former, it would be necessary to replace the existing sewers over a large area at a cost which has generally been considered prohibitory. To lower the subway sufficiently to allow the sewer to pass over it would add greatly to the cost of construction, besides in some instances, inconvenience to the public in requiring the station platforms to be built at an unusual depth below the street surface, or changing the location of the station.

Conditions admittedly requiring a siphon were first encountered in 1902 during the construction of the old subway in the Bronx, at 149th Street and Railroad Avenue, north of the Mott Avenue Station. The old sewer in Railroad Avenue 5 feet circular, has its invert elevation about 2 feet below mean high tide. To pass this sewer under the subway it was necessary to lower it about 10 feet.

Mr. E. W. Clarke, C. E., was in charge of sewer work on this section of the subway at the time, under the Rapid Transit Commission, and designed and supervised the construction of this first siphon. It should be said that it was by his persistent and convincing argument and faith in his design that its construction was finally authorized, against much opposition. Gaging and velocity tests by floats were taken by Clarke at night at low tide and it was found that a 14-inch iron pipe would carry the normal flow at a velocity sufficient, it was believed, to keep this pipe free from accumulated sediment. Two 42-inch storm water pipes were provided on either side of the small pipe, calculated to have capacity equal to the old sewer when running full.

This siphon was put in commission in the early winter of 1903, and has since been performing its functions satisfactorily. In passing judgment upon the efficiency of this siphon it should be borne in mind that it has worked as intended for the past ten years without additional cost to the Borough for maintenance.

In Brooklyn on the Fourth Avenue Route siphons have been built at Hudson Avenue and Fulton Street, Dean Street and Fourth Avenue and at Butler Street and at 35th street.

The Hudson Avenue siphon connects a 4.5 feet by 3 feet egg shaped sewer at an elevation of 10 feet above high tide, the drop being 22 feet to pass below the subway. A 10-inch pipe is provided for the normal flow and a 24-inch pipe for the storm water. The discharge end being at an elevation sufficient to eliminate all tidal effect, this siphon has a great advantage over those at or below tide water level. As a relief in case of emergency a 14-inch by 4 feet conduit, built in the roof, passes transversely across the subway at an elevation 4 feet above the invert of the sewer.

The Dean Street siphon connects a 6-foot circular sewer, the drop being 14 feet

and the discharge end of the siphon being 12 feet above high tide. This siphon is working well and will probably prove one of the most satisfactory built. An 18-inch cast iron pipe carries the normal flow at a good velocity. Two 48-inch pipes are provided for storm water.

Resort to siphons seems to the writer inadvisable unless the volume of sewage is sufficient to effect a minimum velocity of 2 feet per second in a 12-inch pipe.

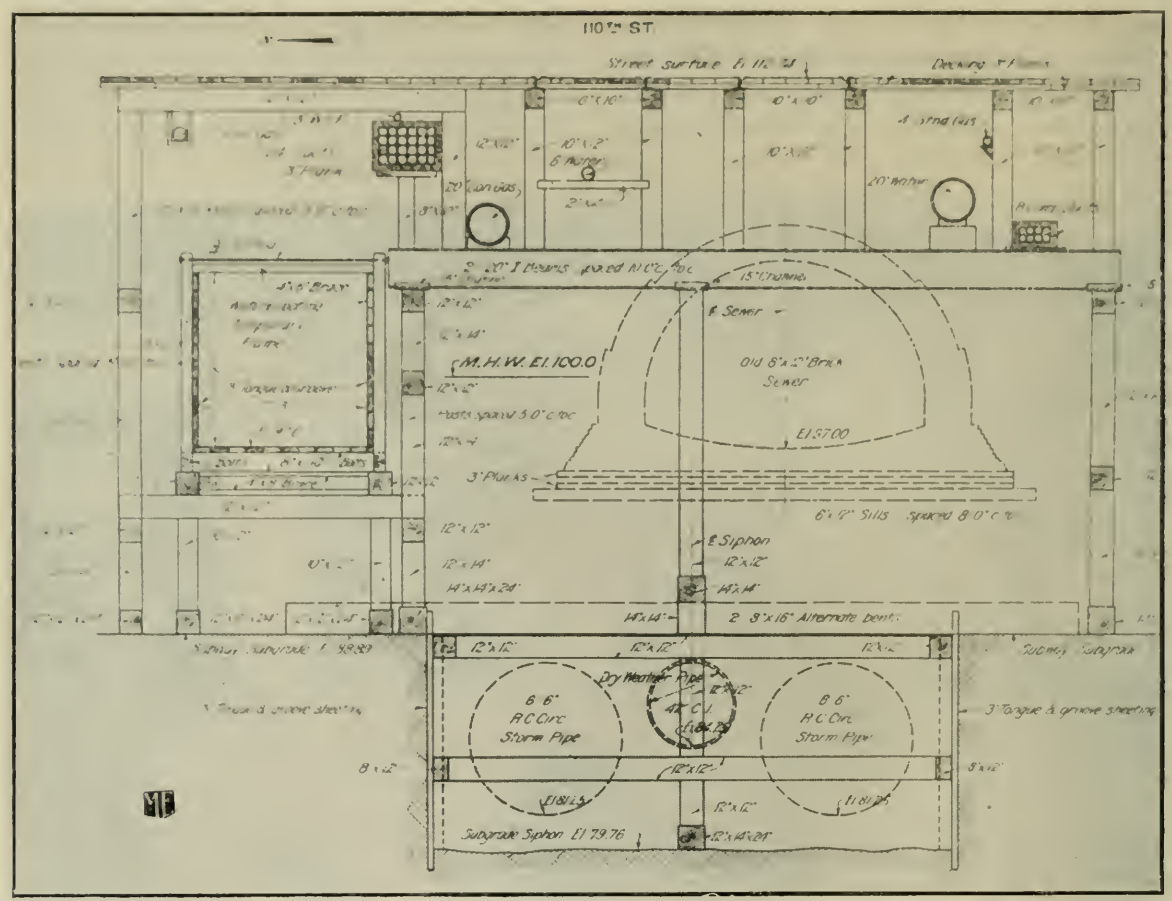
The construction of the Lexington Avenue subway required siphons at 106th and 110th Streets, the former serving a drainage area of 109 acres with an estimated maximum run off of 250 cubic feet per second and a minimum of 9 cubic feet and the latter an area of 227 acres with a maximum of 356 cubic feet per second and a minimum of 29 cubic feet.

To avoid these siphons it would have been necessary to lower the base of rail in the subway 12 feet to allow the sewers to pass over the roof, or to build a trunk sewer in Park Avenue from 110th Street south to 96th Street and thence east in 86th Street to the East River. To lower the subway for about eight city blocks would have added to the cost of construction probably a million dollars and necessitated the placing of the station platforms at an inconvenient depth below the surface of the street, or changing the location of the stations to points off from the main lines of cross-town travel. To build a new sewer in Park Avenue and 96th Street with the necessary laterals would have cost probably over a million and a half of dollars, which was considered prohibitory.

INTAKE CHAMBER *nearing completion, showing 42-inch cast iron pipe below and inlets to the two 6.5-foot reinforced concrete storm water pipes above, which rise on the opposite side of the subway to a similar outlet chamber and discharge thence again into the sewer, which is largely below level of high tide.*

It was the intent in designing these siphons to make the dams controlling the flow through the dry weather pipes at an elevation a little above mean high tide,

thus confining the entire normal flow to the smaller pipes and obtaining in them the greatest average velocity without raising the water in the sewer up stream from the siphons higher than it had been rising previously at high tide. This is the material difference in design from the Railroad Avenue siphon previously referred to. In the Railroad Avenue siphon all pipes are submerged and obtain some




TIMBERING *for excavation for inverted siphon at Lexington Ave. and One Hundred and Tenth St., showing excavation below subway for siphon pipes, the temporary flume for carrying sewage during construction, the cross-section of the sewer cut by the subway and joined by the siphon pipes, and the method of carrying water and gas pipes and conduits across the excavation.*

velocity twice daily, while these siphons rarely take storm water in the larger pipes except during storm at high tide, the dry weather pipe being adequate to carry an ordinary rain storm, at ebb or low tide obtaining of course great velocity.

Another feature introduced with these siphons is the by-pass to facilitate cleaning the dry weather pipe should it become necessary. See horizontal section in accompanying plan. This consists of a circular conduit of the diameter of the small pipe and passing from the chamber on a level with the invert of the sewer, through the dam and into one of the storm water pipes at each end of the siphon. A sluice gate in each chamber when closed renders the passageway inoperative, but by opening the gates the flow freely passes into the storm water pipe to the full capacity of the dry weather pipe. A temporary dam of sandbags easily constructed across the chamber between the end of the dry weather pipe and the by-pass conduit in each chamber will allow all the flow to pass through the storm pipe, thus rendering the dry weather pipe inoperative, without raising the water in the sewer. This appears to be the only device so far that will prove really helpful in cleaning the small pipe. Another use to which this device could be put would be to open these gates in time of storm, thus doubling the capacity of the dry weather pipe and securing a velocity in the storm pipe suffi-

cient to keep it open, if not free from sediment, besides holding the water in the sewer during storms to the same level as prevailed before the siphons were built. It would require a storm of unusual intensity to overtax these two pipes except at high tide. Study along this line may lead to further improvement in design.

These siphons are provided with clean-out manholes for the small pipes at each side of the subway structure, entrance to the pipes from the bottom of the manholes to be obtained by removing the upper part of the pipe. The pipe at these manholes being special castings, the flanges milled and bolted together, lead gaskets being used. The construction of these manholes was the most annoying part of the work and they are of doubtful utility.

The 106th Street siphon connects a 5.25-foot circular sewer the invert of which is 2 feet below mean high tide and has a drop of 14 feet. This siphon as also the one at 110th street was built by the Oscar Daniels Co., contractor for section 12 of the Lexington Avenue subway, during the summer and fall of 1912. The construction was carried out according to plan and without incident. The flow during construction was carried in a wooden flume 6 feet deep and 5 feet wide. Excavation below the subgrade of the subway was in clay practically impervious.

The 110th Street siphon having a drop of 16 feet connects a horseshoe shaped sewer 12 feet wide by 8 feet deep with a flow line elevation 3 feet below mean high tide. The old sewer was built of brick upon timber grillage, consisting of two courses of 4 inch by 8 inch spruce crossed diagonally. Cross section is shown in the drawing, showing system of timbering used in the excavation and the temporary flume for carrying sewage during construction of the new work. The material excavated below the subway was sand and clay, very wet. For about half the distance across the subway, rock was encountered for about 2 feet depth above subgrade.

A wooden flume 7 feet wide by 6.5 feet deep was first built north of the siphon trench which carried the flow during construction without overflowing. It may be of interest to note that the highest point to which the water in the sewer has risen since the beginning of this work was 3 feet 6 inches above mean high tide or 6.5 feet above the flow line. This was at night during high tide and a violent rain storm, the water rising in the flume to within 4 inches of overflowing.

This siphon has a 42-inch cast iron pipe for the normal flow and two reinforced concrete circular pipes 6.5 feet inner diameter, and required a trench 22 feet wide.

As the excavation progressed a sump was carried down outside the sheeting to a depth of 4 feet below subgrade, from which a 6-inch centrifugal pump, electrically driven, controlled the water. 24-in. I-beams, 32 feet long were placed across the siphon trench 10 feet apart and doubled under roadway of Lexington Avenue, strongly supported at each end outside the trench, and by posting in the center. These I-beams carried the surface and subsurface loads, giving room for bracing and sheeting the trench below the subgrade of the subway in the usual way without difficulty. Three-inch tongue and groove sheeting was used, the timbers being generally 12 inches by 12 inches. When the excavation was completed, 6 inches to 8 inches of concrete was placed in the bottom and banked somewhat on the sides to hold the toe of the sheeting as well as to afford a solid working floor. The reinforcing rods were then assembled, wired and supported in place, and inside of these the forms were placed and concrete was poured. Collapsible steel forms were used. The 42-inch pipe was then set and calked, after which the centers, the same forms as used for invert, were placed, the remaining reinforcing rods assembled, and the remainder of concrete poured. The accompanying photograph shows the chamber at one end of the siphons near completion.

On September 22d, 1912, water was turned into the 106th Street siphon and on December 7th into the 110th Street siphon, since which time each has been working satisfactorily.

Efforts have been made from time to time to obtain authoritative information of velocities and tidal effect, but as yet our data are too meager to warrant any

conclusions at 106th Street, except to satisfy ourselves that this siphon has not resulted in raising the water in the sewer above the siphon to any appreciable extent at any time of tide or during storms.

At 110th Street observations have been carried on more thoroughly, and of late systematically, which if pursued for a sufficient length of time may give data of value.

On February 22d occurred the highest tide that has been observed since the siphon was put in operation, the water rising to an elevation of 1.82 feet above mean high tide and reaching the same elevation in the chambers at each end of the siphon. At this time temporary dams had been built upon the permanent dams to an elevation above the water level this day, so that no water entered the storm pipes. It would be very interesting to know just what was happening in the 42-inch pipe at this time when the surface elevation at each end was the same. There appeared to be velocity down stream from surface indications. Proof of this is lacking, but the instant the tide began to subside there was no uncertainty, and the volume of water carried through this 42-inch pipe was obviously enormous.

On February 21st, time of high tide being 9:55 a. m. at Hell Gate, readings taken every 15 minutes showed a difference in the water level of the upper chamber and the lower chamber of an average between 10 and 11 o'clock a. m. of 1.86 inches, the water in the upper chamber subsiding 3.12 inches and in the lower chamber 3.84 inches. During this hour a bottle attached to a fish line was passed the entire distance through the 42-inch pipe three times at velocities as follows: 1.62 feet, 1.74 feet and 1.78 feet. From 11 to 12 o'clock four readings showed an average difference of water level in the two chambers of 1.74 inches, the fall in the upper chamber being 2 inches and the lower 2.88 inches. Bottle tests showed about the same velocity as obtained the previous hour. From 12 to 1 o'clock p. m. four readings showed an average difference in the two chambers of 2:16 inches, the fall in the upper chamber being 6.6 inches and the lower 7.08 inches. No bottle test was made during this hour. From 1 to 2 o'clock four readings showed an average difference of 3.36 inches, the fall in the upper chamber being 1 foot and the lower 1.08 feet. The bottle tests were unsatisfactory but indicated that the velocity did not increase conformably with the change in head.

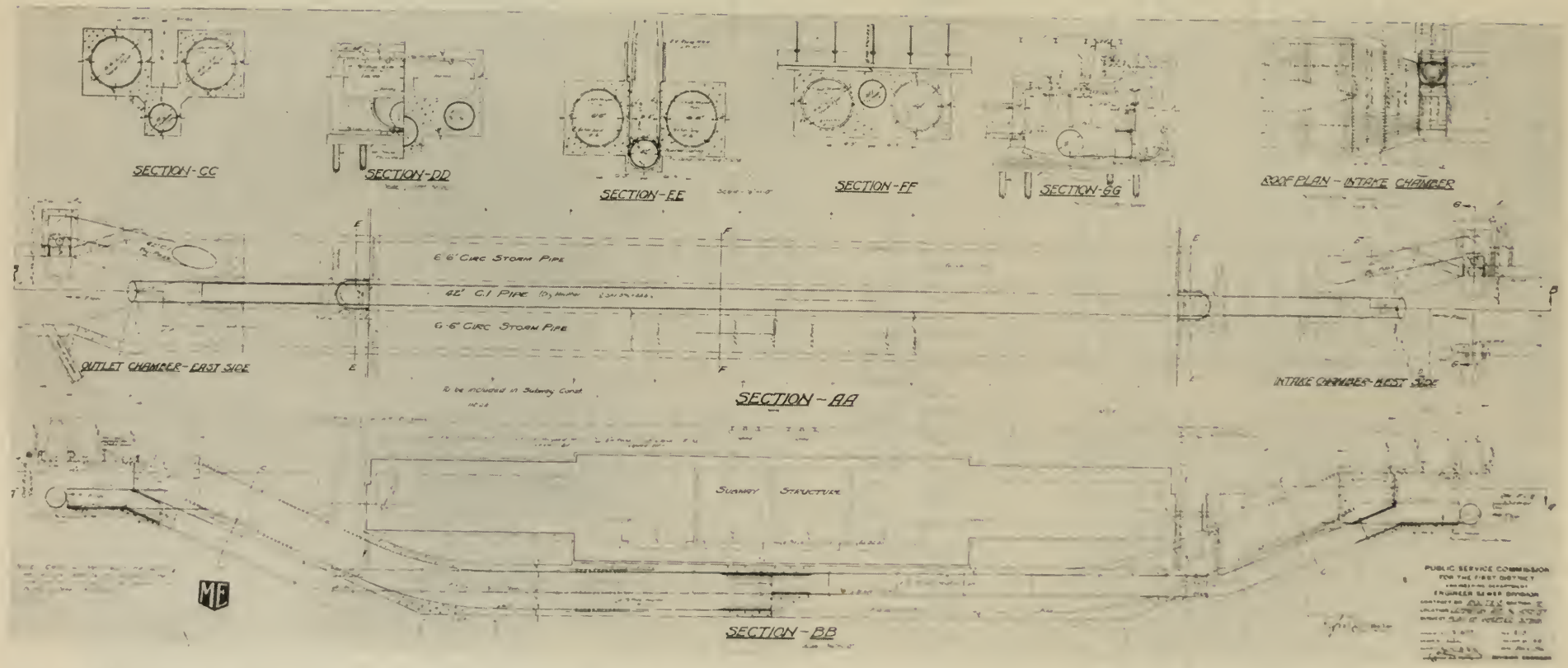
Owing to the large amount of sediment carried in this sewer it soon became apparent that satisfactory results would not be obtained with bottle tests without days of effort, and the use of a current meter was authorized.

On March 5th experiments with an electric meter were undertaken in the afternoon at low tide for two and one-half hours and the results were sufficiently satisfactory to justify further efforts.

The meter was operated as follows: Two 1-inch gas pipes, one 12-feet, the other 10 inches, were joined with a 90-degree coupling and the meter was attached to the short leg. Two hangers were arranged on line with the pipe and at elevations on line with the slope of the pipe at a height to place the meter in the center of the pipe. The 12-foot leg of the gas pipe was then placed in the hangers and lowered into the pipe until the meter was 4 feet from the end of the pipe. The batteries rested on the dam. A working platform was arranged over the invert of the chamber. To clean the meter it was pulled up out of the pipe along the hangers and then raised above the water surface.

If the meter is kept in proper operation one-tenth of the time it is a good average, the remaining time being spent in raising, cleaning and replacing.

There was doubt as to whether this 42-inch pipe was free from sediment, and a drag was made consisting of a channel iron bent to a radius one inch less than the pipe, and covering one-third the inner circumference of the pipe. To this lines were attached to hold, and at the same time pull this drag vertically and transverse to the pipe. A piece of iron plate 1 inch by 6 inches by 13 inches was fastened as an anchor. This drag was pulled through the pipe twice without




PLANS AND SECTIONS *of inverted siphons in sewers to pass under the subways at Lexington Ave. and One Hundred and Tenth St., Borough of Manhattan, New York. Section BB shows a vertical section of the subway, the siphons, the intake and outlet chambers, manholes, etc. Section AA shows a horizontal section of the 42-inch pipe, the two 6.5-foot storm pipes, the by-pass to turn sewage from 42-inch pipe for cleaning it, the intake and outlet chambers, manholes, old sewer, etc. Other sections show the relative positions of siphon pipes, and other structures at different places.*

difficulty. No sediment was removed from the pipe, and no obstructions were encountered. All who witnessed the operation were fully convinced that the pipe was clean.

On March 10th, with high tide at 10:57 a. m. at Hell Gate, current meter tests were again begun at 10 o'clock a. m. and continued until 10 o'clock p. m. The tide this day was unusually low. A drizzling rain set in at about 6:00 p. m. and at 8:30 p. m. had increased sufficiently to make flow in the gutters. The storm gradually increased until 10:15 p. m. when the observations ceased. This storm was unfortunate in giving an abnormal velocity, but shows how slightly an ordinary rain storm raises the water in this sewer, and the capacity of the 42-inch pipe to handle it in addition to normal flow, even at an incoming tide.

The difficulties of obtaining results satisfactorily were well tried out. Many of the meter readings should be eliminated. Among the unusual things caught by the meter was an umbrella frame with in indescribable mass of trash attached, including wearing apparel. A needle and thread were also caught. Human hair and factory waste were constantly annoying.

This work was performed for the Public Service Commission under the direction of Mr. Alfred Craven, chief engineer, and Mr. Robert Ridgway, deputy chief engineer.

# DEDICATION OF LOS ANGELES AQUEDUCT

The ceremony of the dedication of the aqueduct of the Los Angeles water supply, which was announced for May 13-15 in the article on this monumental structure which appeared in the April number, is now set definitely for June 17 and 18. The Los Angeles Chamber of Commerce plans a celebration at that time on a scale commensurate with the magnitude and importance of the work.

The intake gates at the upper end of the canal, shown on page 293 of the article above referred to, were opened on February 13, 1913, by eight of the men who have been most interested in the process of construction, including William Mulholland, chief engineer; H. A. Van Norman, J. B. Lippincott, Charles H. Lee, Roderick Mackay, William W. Hurlbut, Frank G. Henderson, and George Shuey. The water from Owens river is now flowing thru the 61 miles of canal, lined and unlined, which carry it to the Haiwee reservoir. This reservoir will contain 63,800 acre feet of water when full. About the tenth of May the gates of this reservoir, shown in the photograph of the gatehouse in the empty reservoir on page 295 of the article in the April number, will be opened and the water will then run thru the 100 miles of covered conduit, 12.5 miles of inverted siphons and 48 miles of tunnels to the Fernando reservoir, whose capacity is 25,000 acre feet. From this reservoir the water will be distributed to the city and other towns and irrigation districts, as described in the article above referred to. The Chamber of Commerce gives itself a month of leeway on the celebration altho there is no apparent reason at this time why the water should not reach the Fernando reservoir on schedule time.

# IMHOFF TANKS

THE Imhoff tank is the most modern instrument for removing putrescible substances from sewage, and Professor Ogden has stated the principles of its design very clearly in a paper read before the Dallas convention of the American Society of Municipal Improvements from which the following is abstracted:

The problems to be solved in connection with the use of our streams for carrying sewage are: How may an engineer gage the ability of a stream to receive pollution? How may the amount of organic matter in waste material be reduced or modified, so that the results of the treatment shall permit the wastes to be turned into a stream already overloaded?

The first definite assertion was that a stream would receive without detriment one-fiftieth of its volume of sewage, but would not receive one-twentieth. Recently great stress has been laid on the amount of dissolved oxygen found in the stream, and one treatise says that there is a conflict of opinion in this regard, the range varying with different writers from 20 to 70 per cent. of that necessary to saturate the water.

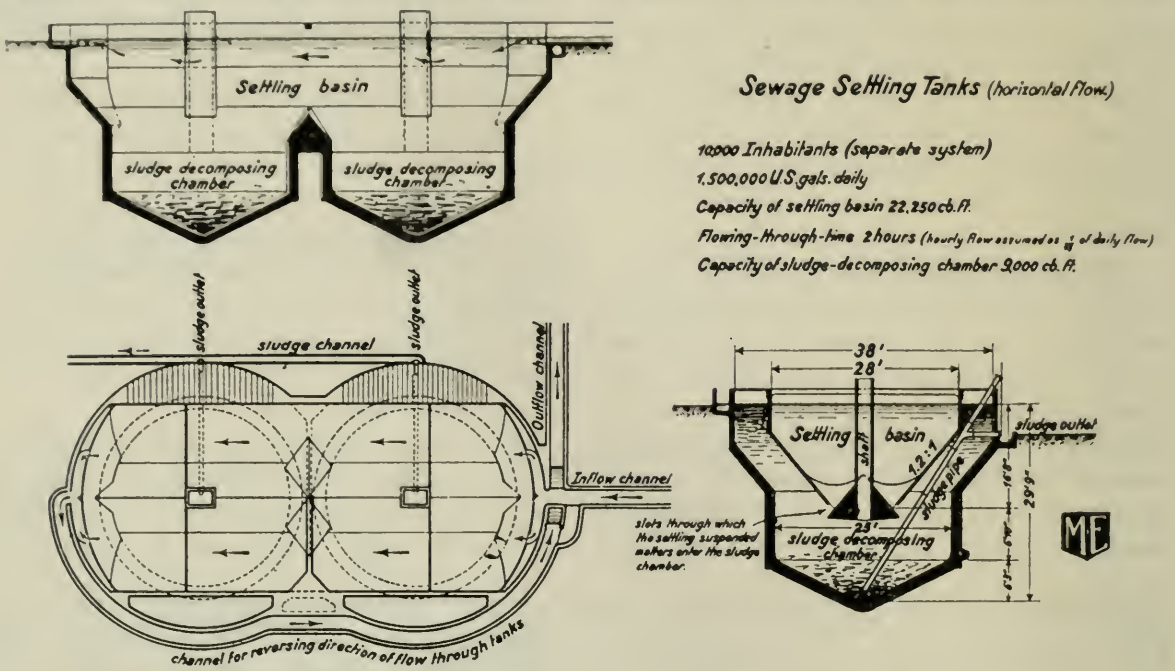
The English sanitarians have attempted to agree upon chemical standards which should draw the line between permissible effluents and those not fit to enter streams. Thus, the Rivers Pollution Commission of 1868 required that no liquid should be discharged into any stream if it contained in suspension more than one part dry organic matter in 100,000 parts of liquid, or more than three parts of dry mineral matter.

The lower Hudson, near Poughkeepsie, is, and always will be, a polluted stream, while the upper Delaware is an overgrown mountain brook. He would be a bold man, indeed, who would ask on purely sentimental grounds that the sewage of Poughkeepsie be purified to the same extent as that of Cooperstown, both cities now discharging crude sewage into the above mentioned rivers.

Out of our uncertainty as to requirements comes a clear note from England as a result of a lawsuit over the pollution of one of their rivers—the Tame. The

IMHOFF TANKS *at Essen, North Germany. There are three pairs of tanks in each group, or eighteen tanks in all, each* 30 *feet in diameter and* 33 *feet deep. Sewage flow,* 17,000,000 *gallons a day. Sewage remains in tanks one hour.*

city of Birmingham alleged that the sewage it was turning into the river was purified quite enough for such a river as had to receive it, while the River Commission claimed that the sewage must be completely purified, no matter what the quality of the river water. The decision of the court was that, "You may not discharge into any stream that which makes it worse." Nobody may make worse a stream by discharging the water into it that has received its excrementitious matter. The principle thus established may not be precisely that which should always govern the degree of purification required in the United States, but it does indicate the tendency to design each sewage disposal plant with particular reference to the degree of purification required by the particular stream into which that particular sewage is to be discharged. No longer, then, will expensive sand filter beds be built to convert sewage into drinking water when the stream receiving such water is already foul.




PLAN AND SECTIONS *of a pair of Imhoff tanks for purifying sewage.*

In the early days of English experimenting, great attention was given to the suspended solids. Apparently it was felt that if the visible particles could be removed, it was all that could be asked. Chemical precipitation, particularly from 1880 to 1890, seemed to be the most promising method of securing this, and chemical salts might have been today the basis of sewage purification except for the trouble which the precipitated solids gave. About one-half of 1 per cent. of the volume of sewage treated was precipitated as sludge, and the problem of disposing of this was most serious. Today the cities of Worcester and Providence, where some twenty to thirty cubic yards of sloppy, putrescible sludge must be removed inoffensively every day, would, doubtless, consider the sewage problem solved if this foul-smelling mass could be eliminated.

The Imhoff tank has for its claim on the attention of engineers two points; namely, it will, so it is said, remove from the sewage passing thru it at least as much, if not more, of the solid matters contained as any other analogous method, and it will so affect the sedimented solids that they will not smell on standing and will dry out easily, decreasing their volume at least one-half. If the tank will do this last; that is, operate without smell and cut the amount of sludge in two, it is well worth having, and the inventor may well be hailed as one of the great benefactors of the human race.

There are two fundamental principles underlying the design and construction of this tank. First, the volume of sewage in which settling is going on is not subjected to any disturbance by rising gas bubbles; and, second, the sludge is allowed to undergo digestion in a deep

tank for many weeks. The first seems like a small matter, and yet anyone who has watched in a stagnant pool of surface water a string of bubbles rising here and there to the surface will, doubtless, also have noticed particles of black spongy-looking material following the bubbles upward. In a sewage tank where decomposition is going on the phenomenon is the most marked, and it is not uncommon for bubbles to bring up to the surface of such a tank pieces of sludge as large as a man's hand.

It now seems a little thing to argue that better sedimentation would be obtained if the bubbles could be eliminated, and yet a trapped tank bottom for sewage sludge is apparently a real invention of Mr. Imhoff. The trap is very simply made by making the bottom hopper-shaped (which also facilitates the downward motion of the sludge) and by carrying one side past the other so that gases rising from underneath are deflected up along the outside. The beneficial effect of this sort of tank bottom is unmistakable and may be gaged by figures so far as they are available, showing comparisons between this tank and others in the percentage of solids removed from the sewage.

Mr. Fuller says that from 50 to 65 per cent. of the total suspended matter in well-screened sewage can be removed by sedimentation in basins holding from six to twelve hours' average flow. Mr. Fuller also says that in all sewage from 30 to 40 per cent. of the suspended matter is so fine that it is not responsible to the laws of subsidence. At Plainfield, N. J., where the tanks are shallow, 54 per cent. reduction in suspended solids is obtained, and at Reading, Pa., 75 per cent. Somewhat more than these percentages can probably be obtained with a deep circular tank. Thus, at Birmingham, England, where Mr. Watson has used tanks 30 feet deep and 40 feet in diameter, 80 to 90 per cent. of the suspended solids can be removed. Probably the exact amount will depend upon the character of the material in the sewage, the presence of chemicals from factories being a factor in the increase of sludge, while a purely domestic sewage is likely to produce much smaller quantities.

With chemical precipitation a greater proportion of the solids can be precipitated. The actual amount of sludge formed is about 50 per cent. greater than with plain sedimentation, and a large part of this consists of the chemicals introduced to effect the precipitation. Probably a domestic sewage which would lose 50 per cent. of its solids by plain sedimentation would increase this amount to 90 per cent. if chemicals were added in the proper amount.

The Imhoff tank is said to throw down 95 per cent. of the "capable-of-settling" suspended solids, and the advocates of the Imhoff tank explain that the term "capable-of-settling" refers to that proportion of suspended matters in the sewage which will settle out in a measuring glass when allowed to stand quiescent for two hours. If Mr. Fuller's estimate of the amount of colloidal matter in sewage not capable of settling is 30 per cent., then the remainder, 70 per cent., is that which remains as precipitable after the use of chemicals; and if the Imhoff tank will throw down 95 per cent. of this, it means that, of the total suspended solids, it will remove 67.5 per cent. This should be compared with the 50 to 55 per cent. which is obtained from strictly domestic sewage, and it is probably correct to say that the increased efficiency of the Imhoff tank, due to the separation of the rising gas, increases the deposit of solids from 10 to 15 per cent.

The second and more important principle of the Imhoff tank, however, and that on which the growing popularity depends, is its remarkable performance in taking care of the sludge after it has been thrown down from the sewage. Three reasons are assigned for this:

In the first place, below the settling tank proper there is provided a large compartment, in which the sludge is allowed to remain for a long period of time, from three to six months, during which time decomposition proceeds and effectively destroys the organic matter, so that when finally the sludge is removed it is odorless and much reduced in quantity. This, however, is not new. As far back as 1899 experiments were carried on at the testing plant of the Massachusetts

IMHOFF TANK AT SANTA MARIA, CAL. *Interior of completed tanks before sewage was turned in. The pipes in the wall are for removing sludge from the sludge chamber below the V-shaped structure. Haviland, Dozier & Tibbetts, Engineers, San Francisco, Cal.*

State Board of Health, in the hope of carrying out complete disintegration of the suspended solids by prolonged septic action in a separate tank. So, in 1908, Dr. Travis built at Hampton, England, a two-story settling tank, thru which the sewage passed at a high rate in the upper compartment and at a low rate in the lower compartment, where the proportion of solids was much greater. In all these cases prolonged settling in a tank resulted in a gradual and general disintegration of the organic material, and the amount of sludge to be finally cared for was reduced more than one-half from that originally deposited. Even in the bottom of an ordinary septic tank about one-half of the solids were broken up to such an extent that they did not have to be considered in the matter of final disposal.

But in all these cases disintegration proceeded only with a large emanation of sulphuretted hydrogen, and the process, even when the physical benefits were considered, was so offensive as to be entirely impossible. Perhaps no single element has worked more against a greater use of the septic tank than the fact that during the septic process offensive gases are given off. It is to the elimination of these odors that the energies of the inventor of the Imhoff tank were directed, and for this purpose he provides a separate tank for disintegration of solids, but he carries on that disintegration without producing odors. His second point, therefore, was that there must be thru the sludge compartment no moving or renewed fresh sewage. The construction of the tank seems to solve this problem, and the reason has been given as follows:

In septic tanks the liquid sewage and the deposited sludge undergo decomposition together, while in the Imhoff tank all supernatant liquid passes thru the tank so rapidly that no septic action is obtained, although in the sludge underneath a very high degree of septicization may be going on. It is said, therefore, that the organic matter in solution, either true or colloidal, is that part of any decomposition that is responsible for offensive gases, and that the deposited solids not subjected to renewed application of fresh sewage do not in their decomposition become offensive. This may explain why the Travis tank smells and the Imhoff tank does not. Other theories have been advanced, and, perhaps, for the present, one is as good as another; but the general testimony of engineers who have seen Imhoff tanks in operation is that there is at the tanks and in their vicinity no objectionable odor.

The third point which seems to be fundamental in the design is that the deposited solids shall be overlaid with twenty-five or thirty feet of liquid. Shallow tanks do not seem to be as effective as deep ones, and the reason assigned for this is that the gases of decomposition which are produced in the lower strata

must, on account of the high pressure, accumulate in greater volume, and in their escape produce a greater separation of the sludge particles than in shallow tanks. It is to this action of the gases in the lower layers of the sludge deposits that Mr. Imhoff ascribes the marked porous condition of the sludge, which gives it its rapid-drying properties after being taken from the tank. The decomposition which goes on at the bottom of the Imhoff tank also gasifies and liquefies a large proportion of the solids originally deposited.

It is not easy from a practical standpoint to separate the effect of the digestion of the organic matter in sludge from the effect of decreased water proportion, since both have the result of descreasing the amount of stored material. Based on experiments of Dr. Spilner and Mr. Blunk, chemist and engineer, respectively, for the Emscher Association, the fresh sludge deposited in the lower compartment contains, on an average, 95 per cent. of water. After remaining several weeks or months in the septic chamber, it will contain only 75 per cent. of water, and about one-third of the original matter will have been either gasified or liquefied. Thru these two agencies an original volume of 100 cubic yards of fresh sludge will be reduced, according to their experiments and figures, to a volume of sixteen cubic yards, a shrinkage in volume of about 84 per cent. They assert that thru septic action only an original five cubic yards of dry sludge matter will be reduced 3.92 cubic yards, a reduction of 22 per cent. The largest part, therefore, of the reduced volume is gained by the loss in water, this being pressed out on account of the great depth of the tank, or indirectly by the greater pressure of entrained gas.

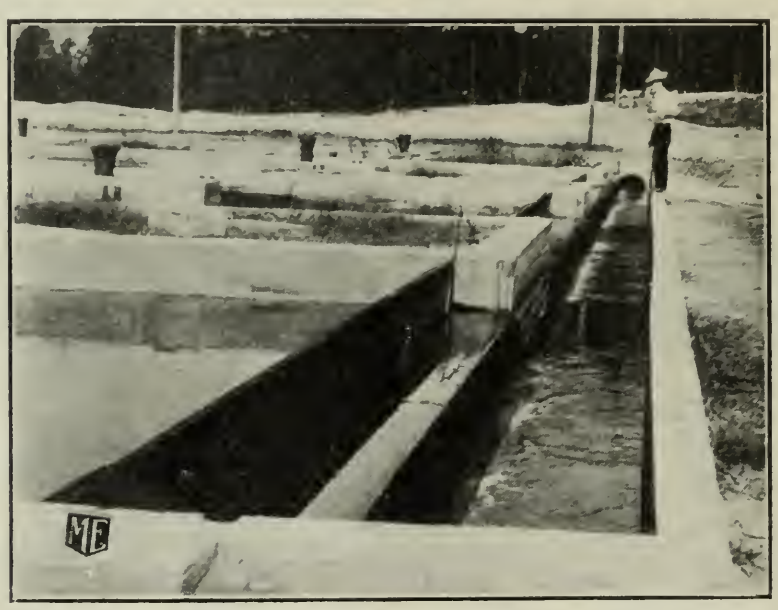
The reduced volume of sludge coming from the tank is not the only advantage. The quality of this sludge is quite different from that of ordinary sludge found in septic or sedimentation tanks. Instead of being compact, non-porous and in texture much like asphalt or rubber, Imhoff sludge is porous and much like a sponge in texture. In the former case drying proceeds with difficulty, and only after prolonged exposure in thin layers to favoring atmospheric conditions. The Imhoff sludge, on the other hand, is so porous that the contained water disappears readily, drying out so that it can be spaded in about five days, and is thereby still further reduced in volume, so that its volume is about 40 per cent. less than when emptied from the tank. In the Essen valley this sludge, except for a slight tarry odor, has always been found by American visitors to be free from objectionable odors, a most marked contrast

IMHOFF TANKS *at Atlanta, Ga.*

to some of the septic tanks and drying beds which have been built in this country.

Perhaps a final word should be said as to cost. An engineer hesitates to recommend the construction of an underground structure when he knows that it involves a continuous fight against underground water and since sewage disposal plants are generally built on the lowest ground, where foundation soil is the poorest and where the ground saturation is most complete, it is inevitable that the cost of tanks 30 feet down will be high. Wisner estimates the Imhoff tank to cost twice that of shallow tanks designed to provide for the same volume of sewage, although the actual volume of the Imhoff tank is somewhat less. The settling compartment of the Imhoff tank is perhaps only one-fourth that of ordinary tanks in volume, but the storage compartment for sludge underneath is so great that the total volume of the tank is nearly that of an ordinary settling tank. Apparently the practice of Mr. Imhoff is to make the upper compartment large enough to hold about two hours' flow and to make the lower one twice this size. This makes the Imhoff tank large enough to hold about six hours' sewage flow, which is about the capacity of the more recently built septic tanks.

The cost of the Imhoff tanks is higher, even with smaller capacity, because of higher unit prices in both excavation and masonry linings. The question, therefore, resolves itself into this: Is the greater sedimentation, the freedom from odor at the plant and the vastly reduced labor of dispcsing of the sludge sufficient justification for an increased cost of constructiontion of the tank and for the patent fee which the inventor very properly claims? It has been said that there is no opportunity for equalizing the variable flow in so small a tank and that for best results a large tank (sedimentation) ought to precede the Imhoff tank action. But with every criticism considered, and with full appreciation of the difficulties of the deep tank construction, the boon of an odorless sewage disposal plant is so great and the elimination of the sludge problem so gratefully appreciated, that its rapid installation in this country cannot but follow its European successes.




GALLERY FOR REVERSING FLOW *thru Imhoff tanks at Atlanta, Ga.*

# EFFICIENCY IN THE PUMPING STATION

*By Seabury G. Pollard, Consulting Engineer, Cincinnati, O., Member of Illinois Water Supply Association.*

EFFICIENCY may be defined as the ratio of actual performance to predetermined standard performance. It is the elimination of unnecessary waste.

Let us consider an ordinary every day pumping station such as those in most of our medium sized cities and in many of our larger ones. The buildings are not always practical. The engine room is fairly well equipped, the bright work and brass bands shine attractively, the floor is fairly clean, not much escaping steam is apparent, there are no cracked steam cylinders, the flywheel is all there, a few records are kept and the engineer is apparently well satisfied with himself and the world in general. The boiler room is usually unattractive. It may be gloomy, dirty and repulsive. Possibly there is an unsightly junk pile in one corner, a dilapidated work bench in another or some broken engine parts under the window. The sanitary arrangements consist of a greasy wash pail and a grimy cupboard. Such conditions are reflected in the employes. The fireman in a listless manner now and then fills the furnace up with coal. He occasionally cleans the fires and takes out the ashes. Possibly more or less steam is escaping thru a blownout joint, the heater may be stopped up, the damper will not work, the coal goes on the fire and "the smoke goes up the chimney" just the same and nobody from the manager down considers for a minute that there exist numerous preventable losses all along the line, which in the aggregate may amount to thousands of dollars annually.

### Efficient Labor Required

To avoid such losses it is necessary in the first place to employ only efficient and intelligent labor. In many municipal plants the executive is spared this trouble. The employes are selected for him, either arbitrarily because of their effectiveness in their respective wards and precincts, or thru the medium of a civil service board. The first method is bad because the qualifications of the appointees are seldom taken into account. The second is often little better because the examining board is not acquainted with the character of work to be done and is therefore incompetent to judge of the fitness of the men. It does not eliminate political favoritism, and the best qualified men, having no difficulty in getting employment, pay no attention to the examinations. Pre-eminently the person best equipped to select the operating force is the engineering executive.

### Operating Standards

The next important problem before the water works operator is the fixing of operating standards. Duty trials of engines and efficiency tests of boilers are or should be made shortly after the installation of this equipment. If for any reason such efficiency trials have not been made or if the results are not available, a competent engineer may be employed to study the conditions existing in the plant, to make such tests as may be necessary or desirable and to establish efficiency standards and proper methods of handling the plant.

To obtain satisfactory results it is necessary that each and every part of the equipment be maintained at all times in the best possible physical condition. In the first place everything should be kept scrupulously clean. The operators themselves are not to be excused from this requirement. Dirt is a visible sign of inattention and where there is carelessness in this particular it generally permeates the whole station. The lawn should be well kept and a flower bed or two may be

added. A picture or two, preferably of up-to-date water works machinery, hung on the engine room wall, a little paint where needed, a neat desk and chair for the engineer and an occasional word of encouragement all assist materially in increasing efficiency. It pays to provide modern sanitary arrangements, including wash room and bath. It pays to provide a light and well ventilated boiler room and to instruct the firemen in the principles of economical firing.

### Objectionable Conditions

Having made the plant attractive to the men the next thing is to see that the machinery is kept at its best. The following conditions which are not uncommon in the engine room have no right to exist:

1. Leaky throttle valves, allowing steam to waste thru dead engines.
2. Leaky steam traps, allowing steam to waste continuously.
3. Leaky valves in small piping and bleeder valves carelessly or unnecessarily left open.
4. Steam leaks at pipe joints or from stuffing boxes.
5. Leaks around steam pistons, due to loose or worn rings.
6. Leaky steam or exhaust valves.
7. Leaky shut off valves in steam pipe.
8. Jacket pressures carried too high or improperly regulated.
9. Steam valves improperly set.
10. Poor vacuum due to dirty condensers, air leaks or vacuum pump being out of repair.
11. Excess friction, particularly on pump plungers, because of tight or improper packing.
12. Improper lubrication.
13. Improperly adjusted bearings.
14. Slip and leakage thru pump valves. This is often the most serious loss in the engine room and in some cases tests have shown it to be as high as 30 and 40 per cent. The cause is wornout valves, improper valve springs, lack of valve area and too high speed.
15. Running engines under throttle when they should be operated under cut-off with throttle wide open.
16. Operating duplex pumps short stroke.

### Structural Defects

Sometimes there are structural defects which can be remedied at comparatively little cost. Such often cause serious losses. Hot water drainage goes to waste when it should be returned to the boilers. Oil is wasted because there is no means for recovering or filtering it. Steam cylinders, steam and hot water pipes are bare or the covering is of poor quality or insufficient thickness. There is a troublesome air pocket in the suction or an unnecessarily large supply pipe has been taken off the discharge main close to the pumps, for feeding a railroad tank or street flusher. Air chambers are of insufficient capacity or improperly located, water hammer and imperfect filling of the pumps result. Suction pipes have numerous short bends or are laid without regard to grade. Possibly there is a whirlpool at the end of the suction pipe carrying air into the pumps. Perhaps the flywheel "works loose" and frequent stops are made to drive the key. Why should these things be?

It is probably true that in the average plant the boiler room losses outweigh all others, the principal one being due to improper or unintelligent firing. In some cases the construction of the boiler plant is so defective that even with good firing satisfactory results can not be obtained. Very often the whole boiler plant has suffered from lack of care and things have gone to the bad to such an extent that efficient results can not be expected.

When the upkeep of the plant is neglected there may be leaky rivets, joints and tube ends, leaky steam traps, leaks around water columns, at nozzles and safety valves, leaks thru apparently closed valves into boilers not in use. The feed pipe leaks, the blow-offs leak, the feed pump is out of order and the tubes in the heater are stopped up. Do any of these things exist in your boiler plant?

### How to Correct Errors

The rational way to correct the errors just mentioned, permanently, is to make the necessary tests and analyses, correct the defects and standardize the condi-

tions of operation. Automatic feed water regulators, recording gages, draft gages, flue gas thermometers, CO2 recorders, Orsat apparatus, gage testers, indicators and the like are very useful and are necessary in making scientific investigations. With one or two exceptions such apparatus unless in competent and experienced hands will do little good.

The principal furnace loss is that due to too much air, furnace temperature being thereby reduced, and 15 to 25 per cent. of the heat of the fuel may in this way be unnecessarily discharged with the stack gases. Insufficient air supply is not uncommon. It is mainly due to defective draft and overcrowding the boilers. With irregular firing there are usually periods of insufficient air supply followed by periods of excess air. Losses both ways.

By all means the best method of increasing boiler efficiency is the installation of automatic mechanical stokers. The cost is about $5 per horse power and even in comparatively small plants the saving in fuel will pay a handsome profit on the investment. Even with stokers the operation should be in accordance with carefully determined methods. Attention should be called to the fact that steam pressures should not vary and that the water level in the boilers should not be carried too high. The first causes loss of both boiler and engine efficiencies while the latter produces wet steam, reduces efficiency and sometimes endangers the engine.

As far as possible supplies should be standardized. It is not ordinarily necessary to purchase the highest priced goods, but exceptionally low prices should usually be viewed with suspicion. Contracts for coal should be made on a heat unit basis.

The care and use of supplies should be as carefully controlled as is their purchase. There should be a definite place for everything and it should be kept there. Incoming stores should be carefully inspected and checked with the order and invoice. Outgoing stores should be measured or weighed. Standard quantities of waste, oil, etc., for a day's use may be determined and the stores issued accordingly. A complete running inventory covering everything in the storeroom is not difficult to keep.

An oiling system in place of the hand regulated cups will save 50 to 75 per cent. of the engine oil, reduce the labor of cleaning 50 per cent. and eliminate hot journals altogether. A little piping, an oil separator and a filter may save 50 per cent. of the cylinder oil. Proper tools conveniently kept, help to keep down the repair account.

### Accurate Records Required

It is still necessary that accurate and detailed records be kept. Records are the connecting link between standards and actual practice and indicate at once the cause of reduced efficiency.

All steam, water, vacuum, receiver, jacket and other gages, engine counters, floats, etc., should be read (not guessed at) at frequent intervals, and the readings should be entered in a properly ruled book. They should also be recorded upon looseleaf report sheets for the superintendent. Automatic records from recording instruments should accompany the report. All coal and ash should be weighed and a record kept thereof. The duty of engines should be frequently calculated and any falling off be investigated and corrected.

Cost records should be kept at the main office. They should take into account not only cash expenditures but the actual cost of maintaining the plant for definite periods of time, which is an entirely different matter. The records should carry enough detail to enable the superintendent to determine at once any variation from standards or unusual expense in the upkeep of any part of the machinery.

# MOTOR TRUCK EFFICIENCY

A recent report prepared by the National Association of Automobile Manufacturers on the lines of industry which were most interested in the use of motor transportation disclosed the fact that in the engineering and contracting businesses there were 482 inquiries on motor trucks as against about 300 for the next closest industry.

Another very healthy indication of the appreciation of motor transportation by contractors is evidenced by the frequent requests which motor truck manufacturers receive for the rental of trucks for some particular contracting work.

One of the most interesting examples of the value of the motor truck in the contracting business is shown in the traffic investigation recently made by the Transportation Cost Department of the International Motor Company. The company in question, The Crescent Delivery Company, New York City, is engaged in the sale and distribution of sand, gravel and broken stone. Their transportation equipment consists, in addition to horse-drawn trucks, of three Mack dump trucks of 7½ ton capacity.

### Conditions

All the hauling is done from the company's dock, at the foot of East 35th Street (with very few exceptions). The materials are delivered for the most part in the downtown section, so that the hauls are short, the average distance being 2.95 miles. Time required for loading and unloading is reduced to a minimum. The various materials handled are carried in large overhead hoppers, which are kept filled by one steam and one electrically operated boom derrick, with clam shell buckets. The trucks run underneath either one of three hoppers, there being one each for sand, gravel, and broken stone, from which they are loaded, in a few seconds, by opening a swinging gate, or valve, in the bottom of the hoppers. These gates are operated by attendants, so that the truck drivers remain on their seats, and move their trucks as soon as filled to make room for other vehicles, of which there are usually a number waiting in line. The motor trucks, as a rule, are given precedence over the horse wagons, not being required to wait in line.

The unloading is accomplished with equal facility, on account of the power dumping bodies, although there are occasional slight delays when the drivers must see the contractor's foreman to ascertain where load is to be dumped, etc. These cases seem to be the exception.

The trucks, being confined to city work, are operated over unformly good roads, excepting at the dock, where the accumulation of broken stone, and the fact that more or less maneuvering is required, doubtless affect the tires to some extent, by abrasive action.

The only causes of delay are these noted above, which are almost negligible, and those due to congestion in traffic in the downtown section.

### Equipment

The three trucks are of standard construction, having bodies of nominal five yards capacity. By loading with a "crown" it is possible to load them with six yards. They were delivered with dual 42 inch by 6 inch tires, of block type, which have recently been changed to 42 inch by 5 inch triple tires, these being endless.

The trucks are geared for a maximum speed of 10.2 m. p. h. the original 13-tooth sprockets having been changed to the present 11-tooth size.

### Operation

The trucks are operated nine hours daily, in which time 6.7 trips are averaged daily. The trucks make an average speed of 9 m. p. h. not including traffic or other stops, while the actual speed,

LOADING SAND *for Perry Sand Company into Mack patent automatic dump trucks. One machine does the work of fourteen wagons and cuts delivery cost in half.*

as governed by traffic conditions, is 7.3 m. p. h. The maximum speed, with engine limited to 1,000 r. p. m. is 10.2 m. p. h.

The average time required to load, from the time the truck arrives at the dock, till it leaves the office where drivers receive delivery slips, is 5 minutes. The average time for unloading is estimated to be 8 minutes.

The loads vary from 15,000 lbs. in the case of broken stone, to 16,200 lbs. for a full load of sand.

The condition of the three machines, at this time, is excellent and it is evident that they are well looked after, even to the extent of frequent washing and polishing of brass.

The drivers are better than the average and take good care of their machines.

### Maintenance

The garage facilities are of the best, and the location of the garage, in East 31st Street, reduces dead mileage to a minimum.

No facilities are at hand for repair work, except light repairs, as there are no machine tools, benches, etc.

Ample provision for daily attention, such as oiling, greasing and minor repairs and adjustments, is made by the employment of one mechanic, all of whose time is given to that work.

Practically no spare parts nor equipment are kept on hand, and in view of the close proximity to the service station, this seems unnecessary.

The figures for mileage, trips, etc., are based on the actual performance of the trucks for two weeks—from November 11th to 23d, inclusive, and were obtained from authoritative sources. The figures for average speed are based on the observations under various conditions. All the above are summarized below.

REPORT ON COST OF OPERATION OF THREE 7-TON MACK DUMP TRUCKS. CRESCENT DELIVERY CO.

*Conditions*:
Average daily mileage.....39.5 miles
Average trips ..... 6.7 miles
Average length of haul..... 2.95 miles
Average load, 8 tons.

*Assumption*:
300 working days per year.
11,850 miles per year (each truck).
100,000 miles, life of truck.

*Investment*:
3 7-ton Mack dump trucks.....$17,400.00

*Fixed Charges*:
Interest on $8,700 at 6 per cent..$ 522.00
Insurance: Fire, 2 per cent. on 80 per cent. of value..... 278.40

DUMPING BROKEN STONE, *Crescent Delivery Co., at Corona, L. I.*

| | |
|---|---|
| Fixed depreciation (exclusive of tires) on $15,450, 10 per cent.. | 1,545.00 |
| Wages, at $22.50 per week..... | 3,510.00 |
| Garabe, at $20 per month..... | 720.00 |
| Total fixed charges..... | $6,575.40 |
| *Operating Charges*: | |
| Depreciation, 1 per cent. per 1,000 miles for all mileage in excess of 1,000 miles..... | $ 285.83 |
| Maintenance, at .079 per mile (approximately) ..... | 2,821.00 |
| Tires, at .0809 per mile..... | 2,877.42 |
| Gasoline, at .067 per mile..... | 2,380.07 |
| Oil and Grease, at .013 per mile... | 468.00 |
| Total operating charges..... | $ 8,832.32 |
| Total cost per annum..... | 15,407.72 |
| Average cost per day..... | $17.12 |
| Average cost per ton mile..... | .108 |

On two consecutive days, in the above period, the trucks averaged 60 miles per day, and, while this is considerably in excess of the general average, it was accomplished without unduly speeding, the machines not working overtime, so that it is apparent that the fact that the average daily mileage is only 39.4 miles is not due to any limitation of the machines, nor loading and unloading facilities.

It seems to be the policy of the company to hold this equipment more or less in reserve to the horse wagons, and while the wisdom of this policy cannot be questioned in view of the fact that the horse equipment costs practically the same whether working or idle, it must be borne in mind that the condition is unfavorable to the most efficient performance of the trucks. On the days when the machines are kept busy the efficiency, or the ratio between ten-mile performance and cost of operation, including fixed charges, must certainly be considered better than that of the horse equipment.

### Conclusions.

The conditions as outlined above, disclose very little which is abnormal, or which would justify any dissatisfaction on the part of the owners. The short

DELIVERING BROKEN STONE *for Hugh Nawn Contracting Co., with Mack five-ton coal truck of International Motor Company.*

hauls, traffic delays, etc., are inherent to the business but these are largely overcome by the exceptional facility with which the trucks are loaded and unloaded. The drivers are under efficient supervision, and there seems nothing in connection with the handling of the trucks, while in service, that is subject to any improvement.

The average consumption of gasoline for the period covered by this report, and since it was known that an investigation was in progress has been considerably less than what it was before, according to Mr. Warren, secretary to the company, and while no deduction should be drawn from this fact, it suggests a better check on this item of expense.

# MOTOR TIRE WEAR IN VARIOUS CITIES

The accompanying tables are but three from the data contained in a report of an investigation made by H. W. Perry, secretary of the commercial vehicle committee of the National Association of Automobile Manufacturers, into the reasons for the variations in wear and tear of automobile tires. This investigation is limited to truck tires and it is evidently impossible to eliminate entirely from it the effect of runs into the country. They are undoubtedly, however, but a small percentage of the tire mileage reported upon.

The first table gives the mileage of each class of pavement in each city covered by the investigation, and the mileage of unimproved streets (earth and gravel).

The second table gives the average mileage of all tires on both electric and gasoline trucks, the total mileage of paved and unpaved streets, and the percentage which the smooth paved streets is of the total mileage of paved streets; also a brief characterization of the topography of the city.

The third table gives the actual average tire costs in the different cities for a one-ton truck.

For any other size of truck the average annuali tire cost per truck can be computed from the following average normal annual tire cost per truck for the various capacities of trucks:

| Truck Capacity—Tons | Av. Normal Annual Tire Cost per Truck |
|---|---|
| 1 | $ 350 |
| 2 | 500 |
| 3 | 700 |
| 4 | 950 |
| 5 | 1,100 |
| 6 | 1,300 |
| 7 | 1,450 |
| 10 | 1,650 |

Table No. 3 and this addendum to it were apparently computed from a combination of costs of trucks of all the various sizes, the list of those in use probably not covering all the sizes in every city.

This computation is of much interest, but it must be taken simply as an indication and not as an actual determination. In the first place the number of trucks is rapidly increasing and so the effect of new tires on the average is greater than it will be after the business becomes more settled. In the second place, purchasers of trucks must learn what is the best tire for their service. Thus the Rapid Transit Motor Company of Indianapolis found tire expense to be very heavy at first, but an increase in size of wheel and a change in design of tire has very greatly diminished the tire expense. Again, many trucks in some cities must run on unimproved streets or area ways, while in other cities the pavements are equal to those on the streets in general, a difference in conditions which is faintly indicated if at all in the tables.

At the present time an investigation of trucks running outside of cities would show even higher tire expense than is here shown, except for the fact that only in three or four states are the main roads so well improved as to attract the truck traffic which is ready and waiting for a

road good enough to make it possible to drive trucks over it at proper speed and with large enough loads to make such traffic profitable.

TABLE No. 1, MILEAGES OF DIFFERENT KIND OF STREET PAVING IN TWELVE LARGE CITIES.

| Paving Material | Greater New York | Boston | Philadelphia | Baltimore | Washington | Buffalo |
|---|---|---|---|---|---|---|
| Asphalt | 755.01 | 22.15 | 490.30 | 36. | 146.33 | 240.8 |
| Asphalt Block | 165.24 | ..... | 15. | ..... | 32.32 | ..... |
| Tar Composition & Bitulithic | 31.3 | 19.89 | 12.77 | 10. | 2. | ..... |
| Wood Block | 34.10 | 3.59 | 2.22 | 2. | ..... | ..... |
| Stone and Slag Block | 16.95 | ..... | 5.82 | ..... | ..... | 21.0 |
| Brick | 19.24 | 5.19 | 171.35 | ..... | 1.40 | 27.9 |
| Granite Block | 306.95 | 98.68 | 394.59 | 43. | 26.10 | ..... |
| Macadam and Telford | 742.38 | 363. | 306.49 | 59. | 90.50 | 15.4 |
| Cobble and Rubble | 44.83 | .29 | 22.81 | 238. | 3.96 | ..... |
| Earth and Gravel | 782.10 | 46.37 | 460. | 38. | 163.56 | 292.8 |
| Other | .62 | 2.19 | ..... | ..... | ..... | 71.4 |
| Total Street Mileage | 2898.72 | 561.36 | 1871.35 | 426. | 466.17 | 669.3 |
| Total Paved | 2116.62 | 515. | 1421.35 | 388. | 303.61 | 376.5 |

| Paving Material | Pittsburgh | Chicago | St. Louis | Kansas City | San Francisco |
|---|---|---|---|---|---|
| Asphalt | 187. | 583.90 | 67.27 | 218.84 | 30. |
| Asphalt Block | ..... | ..... | ..... | ..... | ..... |
| Tar Composition & Bitulithic | 2. | .87 | 45.43 | 1.15 | 157. |
| Wood Block | .48 | 328.79 | 9.38 | 1.33 | ..... |
| Stone and Slag Block | 232.5 | ..... | ..... | ..... | 95. |
| Brick | 65.5 | 181.20 | 171.49 | 38.62 | ..... |
| Granite Block | ..... | 103.34 | 72.32 | 6.50 | ..... |
| Macadam and Telford | 8.6 | 580.80 | 272.53 | 71.19 | 120. |
| Cobble and Rubble | 195. | ..... | ..... | ..... | 10. |
| Earth and Gravel | ..... | 2676.40 | 294.73 | .70 | ..... |
| Other | ..... | 22.18 | ..... | 4.16 | ..... |
| Total Street Mileage | ..... | 4477.48 | 933.15 | 342.49 | ..... |
| Total Paved | 515.58 | 1801.08 | 638.42 | 341.79 | 412. |

TABLE No. 2, TIRE MILEAGE AND STREET PAVING IN VARIOUS CITIES.

| City | Average Mileages of all tire on both Elec. & Gas Trucks | Percentages of Asphalt, Asphalt Block, Bituminous and Wood Block paving to total miles paved streets | Total Miles Paved Streets | Unpaved Streets | Topography |
|---|---|---|---|---|---|
| Baltimore | 3,617.6 | 12.3 | 388. | 38. | Hilly |
| Pittsburgh | 4,542.6 | 36.7 | 515.58 | ..... | Very Hilly |
| Boston | 5,814.2 | 8.8 | 515. | 46.37 | Level |
| San Francisco | 5,869.8 | 45.0 | 412. | ..... | Hilly |
| Greater New York | 6,576.7 | 43.0 | 2287.52 | 782.10 | Level |
| Philadelphia | 7,134.1 | 36.5 | 1421.36 | 460.00 | Level |
| Buffalo | 7,263.2 | 64.0 | 376.5 | 292.8 | Level |
| Chicago | 7,945.9 | 56.0 | 1801.08 | 2676.4 | Level |
| St. Louis | 10,245.5 | 19.0 | 638.42 | 294.73 | Partly Hilly |
| Kansas City | 10,571.4 | 64.0 | 314.8 | ..... | Very Hilly |
| Washington | 11,065.4 | 59.0 | 303.61 | 163.56 | Level |

TABLE No. 3, COMPARISON OF ACTUAL AVERAGE TIRE COSTS IN DIFFERENT CITIES WITH NORMAL AVERAGE COST, TRUCKS OF ONE-TON CAPACITY:

| | | | | | |
|---|---|---|---|---|---|
| Average normal annual tire cost per truck | $350 | 100% | Philadelphia | 392 | 112 |
| Baltimore | 733 | 221 | Buffalo | 388 | 111 |
| Pittsburg | 616 | 176 | Chicago | 350 | 100 |
| Boston | 479 | 137 | St. Louis | 273 | 78 |
| San Francisco | 476 | 136 | Kansas City | 262 | 75 |
| New York | 425 | 121.6 | Washington | 252 | 72 |

# Conditions of Motor Truck Economy

The development of the use of the motor truck began not long after the rapid development of the automobile had been established but its effect in displacing horse-drawn vehicles did not come into evidence strongly until within the last three years. It is not possible to give close definite figures covering all items of cost as yet, but those of operation are now available in considerable numbers. Some of them are given in various articles in this and other numbers of Municipal Engineering and generally show economy in the use of motor trucks.

Certain principles have been discovered to govern the matter of economy and probably others will appear later. Mr. J. O. Handy states some of them in his presidential address before the Engineers' Society of Western Pennsylvania as follows:

"Trucks must be kept in practically constant use.

"They must be loaded to full capacity when in service.

"Loading and unloading must require but a small proportion of the time in service.

"The truck must not be overloaded.

"Normal speed of operation is best.

"Adjustment and repairs should be done by competent workmen.

"The driver must be well qualified for his work."

The figures of cost which are given should be examined carefully to see if all these principles have been followed. One most important element of cost is that of depreciation. Trucks generally are not yet old enough to show what is a reasonable allowance to make for this item. Evidently it must be greater for some services than for others, and will depend largely also on the closeness of adherence to the principles stated.

Mr. Handy states that the number of motor trucks in use in this country is about 50,000. The rapidity of increase in their use is shown by the 62 per cent. increase in one year in number in use in Massachusetts, 100 per cent. in Washington, 120 per cent. in Chicago, and the like.

One line which seems to meet the requirements of the principles stated is that of the motor bus on a regular route running on schedule time. The success of the motor bus on Fifth Avenue, New York, is hardly representative, because of the specially favorable conditions on that street. The history of the Rapid Transit Motor Company, of Indianapolis, is of more general application.

This company began operations in November, 1911, with seven automobiles on a single route. The service is described in Municipal Engineering, vol. xli, p. 478. After a careful trial of this route, part of which gave better service to a section of the city which did not have good street car service, the line was shortened and then was changed in route until a district, still in the same section of the city, was found which promised sufficient traffic to pay. Part of the reason for lack of sufficient financial return was probably the rates of fare, which were 10 cents for a single ride, ten tickets for 50 cents, and twenty-one tickets for $1, while the street cars on adjacent streets for most of the route charged 5 cents single, six for 25 cents, and twenty-five for $1. The service to the district last tested was put on the same fares as the street cars and is now financially successful. On this route, which is somewhat shorter than the first one tested, three buses are run. Three have been put on a part of that first route, and with the lower rates of fare these also are successful. One bus is kept in reserve and repairs take so little time that it is available for special service to parties and the like. In the summer the service is changed somewhat and two buses are used on a cross town line to one of the principal parks, meeting a great demand and having adequate financial returns.

Plans for increasing the service and extending it to other parts of the city are under way.

Besides the economy which can be shown in comparison of such service with horse-drawn vehicles is that in comparison with the street car system, when traffic is not too heavy and lines are not too long. The bus line has the further advantage that is it movable and can be put on any line which gives the best returns and thus meets the demands of the public most nearly. The advantage of having single units of power is seen when snow delays the whole system of street cars, while the bus can pick its way and get thru somehow. It is also shown when the power house is out of commission, as in the late floods, when the only regular method of transportation available for several days was the bus line. There is a large field for this sort of development which is now open. The experiments which have been made on small scale in a few cities have given a basis for others which can take advantage of the experience already gained.

Another condition under which economy of the motor truck can be shown is in short freight hauls. Much of the experience of short railroad haul is in the loading and unloading of cars. This can all be eliminated by using the truck. The ordinary route of a shipment under present conditions is from the store or factory to the truck, from the truck to the freight depot, into the car, out of the car into the receiving depot, and from the freight depot to the purchaser. It is more direct, requires less handling, which adds greatly to the expense, cuts out one company and its profit, and adds nothing to delivery charges at either end, to send the truck to the city or town in which delivery is to be made. The only requirements for economy in the operation are those stated at the beginning of this article. There is much leeway in the terminal expenses to overcome the difference between actual cost of running the automobile and the freight car between the two cities after they are well out of the city and on the way. The economy will be still greater when the roads of the country are improved to meet the increasing demands of this class of traffic, thus reducing the cost of traction and the liability of breakage and accidents.

MOTOR TRUCK AND TRAILER *running in competition with steam railroad from Braunschweig, Germany. Note superior character of surface of road.*

Germany is developing this class of traffic more rapidly than the United States, because the better roads in that country invite it, whereas many of our main roads are wholly unable to carry it. One of the accompanying photographs shows a German motor truck and trailer which is a successful competitor of the steam railway on regular routes running out of Braunschweig.

# SUSPENSION OF TROLLEY WIRES FROM BUILDINGS

*By L. A. Dumond, Engineer, Committee on Down Town Streets, Chicago Association of Commerce.*

The movement to remove trolley poles from the streets in Minneapolis, and later in St. Paul, originated with the company. It was prompted by the desire to remove obstructions from the streets in the downtown district, and to secure a method of construction believed to be safe and more economical. Absolute uniformity could not be secured in all cases because of vacant lots or buildings of insufficient height. Otherwise poles are removed wherever possible. No attempt would be made to attach the eye-bolts used to any frame building, or any building with a thin veneer front. Out of 7,708 poles used in Minneapolis, 500 have been replaced by eye-bolts attached to the buildings. The spacing of trolley poles varies from 100 to 110 feet. Figuring an average spacing of 100 feet, then 50,000 feet, or 9.47 miles of poles are replaced in Minneapolis. The eye-bolts used are made of steel and heavily galvanized to prevent rusting and staining of the buildings. No complaints from this source have ever been received. The eye-bolts cost 16 cents a piece, and the total cost of mounting eye-bolts and attaching the supporting wires is $2.00. The cost of a trolley pole set in concrete in Minneapolis varies from $20.00 to $22.00. Upon original construction the saving made by using eye-bolts attached to buildings in place of trolley poles would have been:

| | |
|---|---|
| 500 poles set up complete, at $20.00 | $10,000.00 |
| 500 eyebolts mounted complete, at $2.00 | 1,000.00 |
| Saving | $ 9,000.00 |

However, Mr. Scofield states that while on new construction they do not now set trolley poles in concrete, most of the trolley poles removed were so set, and the cost of removal plus the cost of mounting the eye-bolts often amounted to as much as the cost of a new pole set up complete.

The city of Minneapolis cannot compel the property owner to permit the attachment of trolley wires to his building. The permission to attach trolley wires is purely voluntary on the part of the property owners and arises from the desire to do away with an unsightly obstruction. In obtaining consents to attach trolley wires to the buildings, the street railway company first sends a solicitor to the property owner who explains the advantage of removing poles and presents an agreement for the property owner to sign as follows:

Permission is hereby granted the Minneapolis Street Railway Company to install ..... eye-bolt.... in the ..... wall of the building located at.....
(Signed).....
.....1913.

In case the property owner does not grant the desired permission, the name is turned over to the Civic and Commerce Association who again take the matter up with the property owner. The Civic and Commerce Association has been very successful in securing consents for mounting eye-bolts upon the buildings, and thus helping to clean up the streets.

The company has never received any complaints as to the interference of these wires in case of fire, nor has the service ever been interrupted from this cause.

There is nothing to the charge that short circuits might be caused in steel buildings. The trolley wires are doubly insulated from the buildings. The trolley hanger used is itself insulated, and another standard wooden insulator is placed in supporting wire at the curb line.

There is nothing to the objection that the eye-bolts might be pulled out because of the great weight upon the supporting wires. But one case of this kind has ever

occurred in Minneapolis. In this case a workman by mistake fastened an eye-bolt into the veneer of a brick building. The company does not attempt to fasten these eye-bolts to a building with a veneer wall only, or to the veneer surface of any building. In all other cases where the eye-bolts have been fastened to the wall of the building itself, to the full length of the bolt (8 to 10 inches) no bolt has ever been pulled out or even loosened. The strain upon these bolts communicated by the supporting wires varies from 500 to 700 pounds, about the same as that existing on the supporting wires in Chicago, according to the statements of Mr. Murphy, chief engineer of the Chicago Railways Co.

For supporting wires a three strand No. 11 galvanized wire is used.

Mr. Scofield states that in case it was feared that the strain upon one eye-bolt might be too great, two eye-bolts might be used, placing one above the other. He has not up to date found this precaution necessary, but states that he would employ it if the conditions warranted.

The width of streets upon which this method of suspending wires is employed varies from 80 to 100 feet. No troubles of any nature have ever occurred in a street of 100 feet width with this method.

The eye-bolts are fastened to the building at a height varying from 26 to 27 feet.

Two objectors to the plan gave reasons as follows:

New York Life Building in Minneapolis; Nichols & Tuttle, Managers: Mr. Nichols says that they at first refused permission to mount eye-bolts because of their fear that the strain upon the wires would pull the eye-bolts from their mounting in the terracotta. Permission was finally granted upon the plea of the Civic and Commerce Association to permit of the installation of an ornamental lighting system with which the poles interfered. No trouble has been experienced as feared and the managers are very well satisfied, and admit the poles were a great obstruction. Mr. Nichols believes that many of the objections originally raised to the scheme were due to not comprehending what the method really involved, and also a false idea as to the amount of pull upon the supporting wires.

Post Office Building in Minneapolis: The custodian of the building could not give permission without authority from the supervising architect in Washington. When the method of suspending wires was explained fully to the supervising architect, permission was granted.

TROLLEY WIRE SUSPENSION *from building on the left and from pole on the right.*

# EDITORIAL

## BUILD THE ROADS FOR THE TRAFFIC TO COME.

The most important question in road design and construction at present is that of the character of the traffic which will be developed over the new road when it is built. Many miles of improved macadam and gravel roads were built by the first state highway commissioners at heavy expense which were fully adequate for the traffic of the day. But the automobile developed into a practicable fast-moving vehicle which proceeded to tear these roads into pieces. Many miles of these roads have received additional treatment or have been more or less completely rebuilt at large additional expense to carry this new traffic.

And now, over these new roads comes a new development of automobile travel, the truck, with or without its trailers, and demonstrates the necessity for still better roads than it has been customary to construct.

Each change in traffic conditions has been contested by means of laws regulating the use of the roads, and each new class of traffic has been assessed what was thought to be its share of the increased expense of maintaining the roads in good condition.

The theory seems to have been that the traffic must be regulated to suit the road over which it must go. But that theory is wrong, as the most progressive commissioners and engineers have long recognized, and the true theory on which we should proceed is that the road must be built to carry the traffic which comes to it. So those states which are just beginning their modern road improvement must consider, in making the design of a road, not what its traffic is at present, but whether the improved road will have a small amount of ordinary farm traffic, a larger amount of such traffic on its way to market and gathered up from the neighborhood roads, a thru traffic of fast-moving automobiles, horse-drawn or motor-drawn heavy traffic, or combinations of one or more of these.

The main roads are those which are most difficult to care for, and it is each year becoming more evident that they must be built with foundations heavy enough to carry any loads which the new traffic can bring to them, and must at the same time have surfaces good enough to withstand lighter rapidly-moving vehicles.

How extensive this new heavy traffic will be is only suggested by the data on truck traffic which are given in this number of MUNICIPAL ENGINEERING and will be followed by more each month on all classes of heavy and light traffic. The necessity of the heavier roads is already demonstrated by figures and will soon be demanded by such traffic, the economical development of which will be handicapped by insufficiency of roads until the road officials of states and counties have the demonstration forced home to them and respond by improving the roads to the limit required.

## ONE FLOOD LESSON.

One lesson has never been taught by experience with floods, which was brought into greater prominence than ever by the March floods which were so phenomenal in Indiana and Ohio and were widespread thruout the Mississippi Valley in particular. This is that of the error in locating public utilities where they are in danger of being put out of service by floods and in retaining them in such locations after this danger is definitely demonstrated.

The main pumping station of the Indianapolis water works was flooded by the breaking of a city levee at some distance from the plant. These works have been in similar trouble at least twice before, and it would certainly be the part of prudence to protect them by their own walls and levees and pumps for removing leakage, if it is not considered advisable to elevate the plant above all danger of overflow. The power stations of the street railway plant, which is owned by one of the interurban systems, were flooded and out of business until the apparatus could all be dried out. There is apparently no reason, except the comparatively small expense, for failure to elevate the essentials for continuous operation without reference to floods, and to protect by levees all parts not subject to backwater from the river thru outlet sewers or conduits. The works of one gas company were practically without protection from flood and stopped manufacture of gas early in the flood. One of the street railway power houses and the gas works were located after the flood of 1904 and must have been constructed with full knowledge of what might happen at any time.

Memphis, Tenn., is safe from overflow except a few acres along a bayou, which area is usually protected by a levee and a pumping plant for sewage and seepage. The gas plant is outside this levee, however, and was protected during the early days in April by a levee of sand bags several feet high, and was in constant danger. There is apparently no very good reason why this plant should not have been located on high ground. The bonding of the city for the construction of a levee along the bank of Wolf creek which will protect this and several private manufacturing plants in the vicinity is under serious consideration. The city water works plant is in similar condition altho it is behind the existing levee. The peculiar circumstances of its development give better reasons than usual for the location.

Terre Haute, Ind., gas and electric light plants were put out of business, but the water works developed only one weak spot, which did not completely close the plant.

Water filtration plants at Albany, Green Island and Rensselaer, N. Y., were put out of commission. That at Columbus, Ohio, seems to have been almost wholly protected.

Ground water supplies at Memphis, Tenn., and Oswego, N. Y., were polluted to some extent by inflow of flood water. That at Dayton, Ohio, was so well protected that no surface water entered, and as soon as the pumping plant could be started and the broken pipes and hydrants shut out of the system the usual supply was furnished in the usual condition.

Water, light and power plants in many smaller cities were put out of commission.

When plants in cities so seriously flooded as Columbus and Dayton come thru with no damage to their water supplies, altho the floods very seriously damaged their distribution systems, there seems to be no very reasonable excuse for the other cities, especially for those that have built plants in recent years with their frequent floods approaching or exceeding former maximum levels.

# MEN PROMINENT IN MUNICIPAL AFFAIRS

Photo by Moffett, Chicago.

JOHN ERICSON, *City Engineer, Chicago.*

John Ericson, city engineer and chairman of the Harbor and Subway Commission, of Chicago, Illinois, graduate of the Royal Polytechnic Institute, Stockholm, Sweden, in 1880.

After three years' service in minor capacities with the United States government, private and public corporations, Mr. Ericson entered municipal service as a draftsman in the engineering department of Chicago in 1884; he was steadily advanced through the positions of assistant engineer, and first assistant city engineer, until 1897, when he secured the appointment of city engineer.

As city engineer, Mr. Ericson has

charge of the Bureau of Engineering, which is made up of the following divisions: Pumping station and crib division, directed by a mechanical engineer in charge, who supervises the operation, maintenance and repair of all pumping stations and cribs; the water pipe extension division, in charge of a superintendent, to whom is assigned the work necessary in the repair, extension and management of the water carrying facilities and waste water surveys carried on by means of pitometers; the construction division, reporting to the engineer of water works construction, to whom is assigned all construction work performed by city or private forces; the water works shop and repair division in charge of a superintendent, to whom is assigned the work of making repairs to boilers, pumps, hydrants, valves and other city property; water meter shops division, reporting to the general meter foreman, who makes the necessary repairs, replacements and installations of water meters; the division of bridges and viaducts, directed by an engineer in charge, to whom is assigned all work necessary in the design, construction, operation and maintenance of bridges, viaducts, docks, etc.; the division of rivers and harbors, which has supervision over the Chicago river, the Calumet river and Lake Michigan for a distance of three miles from shore, enforcing such municipal laws as relate to marine interests, such enactments of the state legislature and the regulations of the United States government in regard to rivers and harbors; and the testing division, in charge of an engineer of tests, to whom is referred such materials as require testing for compliance with specification.

Since acting as first assistant city engineer and city engineer, the pumping stations of the city have increased from two to fifteen in number, the capacity from 350 million to 900 million gallons per twenty-four hours, and the distributing mains from 1,400 to 2,500 miles in length.

After having become city engineer, Mr. Ericson devoted considerable time to the study of bridges and under his supervision there has been developed a special type of bascule bridge, the first of which was constructed in 1901. There are now ten of these bridges in operation, five under construction, and plans for several more are being prepared, notwithstanding the fact that the installation of these bridges has been retarded more or less owing to the opposition of people who own or control patents on other designs.

No difficulties present themselves to the city engineer more than those connected with the development and maintenance of an adequate water works system, and these are especially pronounced in Chicago, owing to the peculiar nature of the city, which has an exceptionally large area, with well built up suburban districts on the outskirts, requiring extra heavy pumping and distributing facilities. Other difficulties demanding attention along this line are old and defective plumbing, which increases leakage and waste, and an over-abundance of underground feeder wires, which has done considerable damage by electrolysis.

To give the reader an idea of the amount of work performed under the direction of the city engineer of Chicago, it is thought advisable to quote from a recent annual report of the bureau, which shows the following work having been done during the preceding year: 71.17 miles of water pipe laid; 1,690 fire hydrants and 673 valves placed and connected; 185,176,323,000 gallons of water pumped against an average head of 114.99 feet at a pumpage cost of $0.0356 per million gallons 1 foot high; pitometer surveys covering twelve square miles of densely populated city area, resulting in the elimination of the loss of 19 million gallons of water daily due to defective plumbing and underground leakage; the completion of the southwest land tunnel system, comprising tunnels from 9 feet to 14 feet in diameter, constructed thru rock under Lake Michigan and the streets of Chicago, with a capacity of 400 million gallons daily, at a cost of $3,062,520; the completion of bridges previously started and the preparation of plans and specifications for the bridges now under construction.

As chairman of the Harbor & Subway Commission, Mr. Ericson has directed the preparation of reports on routes and estimates of costs for a subway system to be utilized in connection with the present elevated and surface car system. The estimated cost of this system exclusive of equipment, is about $20,000,000.

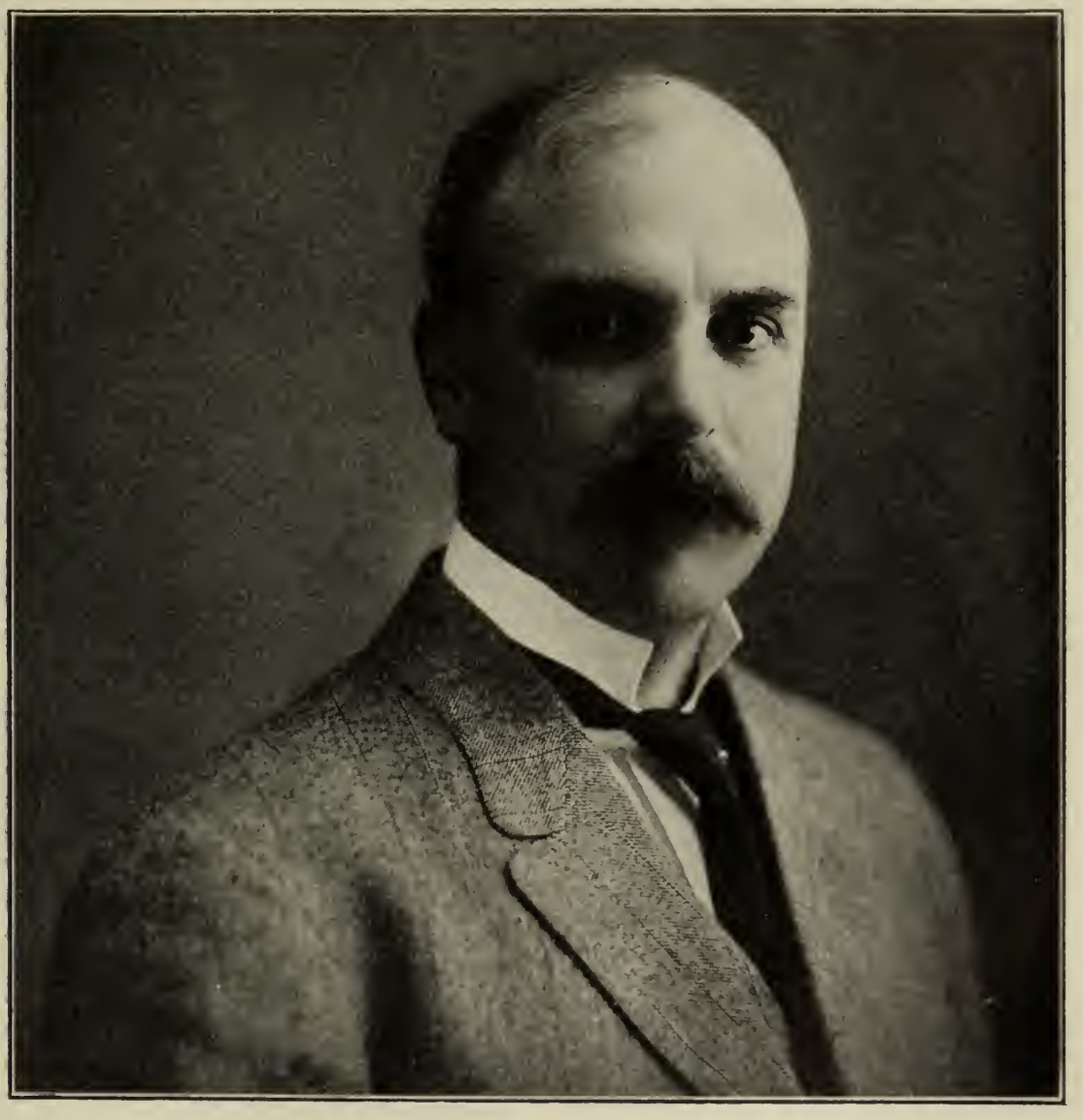
Plans have also been prepared for a comprehensive system of subways to be operated independently of present transportation system. The estimated combined capacity of this independent subway system is 180,000 seats per hour. The estimated cost of these subways, including stations, is $96,200,000. The necessary trackage, electrical equipment, rolling stock, etc., to furnish a complete system, ready for operation, will require an additional expenditure by the operating company of some $35,000,000.

Also the plans for the initial construction of two piers, one for freight and one for passengers and package freight, at a cost of $5,000,000. The piers, when completed, will be 292 feet wide from dock line to dock line, with an 80-foot roadway in the center, on either side of which will be sheds 100 feet wide, the whole

to be constructed of fireproof materials. Between the docks will be water slips 300 feet wide. These, when completed, will be the start of what is considered the most important harbor development contemplated along the Great Lakes.

Owing to the importance of his position, Mr. Ericson has been asked to and has prepared many technical treatises and reports which are of much interest to those engaged in the practice of municipal engineering. These papers cover a variety of subjects, altho one of special prominence is his treatise presented before the Western Society of Engineers in 1911, showing the result of experiments to determine the elements of flow of water in large tunnels.

Mr, Ericson is a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Western Society of Engineers, and American Water Works Association.



HON JAMES ROLF, JR., *Mayor San Francisco, Cal.*

## San Francisco's Mayor

The city of San Francisco, Cal., points to the splendid record of municipal work already accomplished and gives all due credit to her mayor, James Rolph, Jr.

Mayor Rolph's administration has been essentially one of big municipal achievements. He believes in action and has succeeded in permeating the whole city government with his ideals.

Mayor Rolph has mapped out a big program of work for the year 1913. Every phase of municipal developments receives his personal attention.

Nineteen Twelve will be celebrated in the civic history of San Francisco chiefly as the year in which municipal car service was put into operation. The completion of the Geary street municipal railroad and the inauguration of car service at the close of the year was the realiza-

tion of one of the city's fondest dreams, and it gave San Francisco the distinction of being the first of the great American cities to operate its own car line.

Excellent progress has been made upon the auxiliary high pressure water system for fire protection since Rolph went into office, and the records show that sixty-nine miles of pipe out of a total of ninety-one have now been installed.

In this connection the mayor accomplished a big saving for the property owners of San Francisco last year by holding the insurance companies to their promise that rates would be lowered when the system was completed. After a series of lengthy discussions with the board of fire underwriters the mayor succeeded in obtaining an average reduction of 25 per cent., which will mean an annual saving of approximately $1,000,000 to the policyholders of this city.

Three million dollars' worth of land has been purchased for the civic center and an equal amount remains yet to be secured. Despite the fact that a blanket condemnation suit was filed, covering all the land, the city has been able to obtain the necessary property in most cases without resorting to the courts.

Ground plans have been prepared for the entire project, which the architects promise to make a show place of which the city can justly boast.

### Giant Sewer Complete

Among the most noteworthy municipal undertakings completed during 1912 is the construction of the North Point sewer, the largest ever built in this city. The huge pipe will afford drainage to 80 per cent. of the homes of the city and will handle the sewage for an area of approximately 11,500 acres. It will cost $1,500,000 and reaches from the county line to the bay, emptying at the foot of Grant avenue. Drainage water was turned in for the first time this week. The monster sewer will do away with the necessity of operating the numerous smaller sewers which now discharge at various points along the waterfront. Its completion will reduce the number of outlets from 125 to five.

During 1912 a total of $5,500,000 has been spent on sewer projects. One of the most important of these is the big storm water relief drain in Division street. A large section of the southern part of the city has been provided with proper drainage. The Forty-eighth avenue sewer, serving the Park, Richmond and Sunset districts, has been completed. Permission to connect the Panama-Pacific Exposition drainage system with the city sewers has recently been given.

The attention of the mayor is devoted largely at present to the solution of the water supply problem. The trip of the officials to Washington in the interest of the Hetch-Hetchy project is expected to be crowned with ultimate success. The administration is still engaged in daily investigations looking toward the acquisition of the Spring Valley Company's plant.

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## F. G. Simmons

Mr. Fred G. Simmons, commissioner of public works of the city of Milwaukee, received his education in the common schools and collegiate institute of St. Catharines, Ontario, Canada, removing while still a young man to the city of Denver, where he learned the machinist trade. Becoming satisfied that this did not offer sufficient field, Mr. Simmons took a course in civil engineering and in 1888 became connected with the Denver City Tramway Company in charge of roadway and tracks.

In 1897, Mr. Simmons removed to Milwaukee as engineer in charge of the tracks and roadway of the Milwaukee Railway & Light Company, at the instigation of Mr. T. E. Mitten, then general superintendent of that company, and continued with them under Mr. John I. Beggs until April, 1912, when he assumed his present position, that of commissioner of public works of the city of Milwaukee. Mr. Simmons is forty-seven years of age and has been for twenty-five years in active engineering work.

Mr. Simmons has made quite an exhaustive study of the use of the "Tee" rail in street railway construction. While in charge of roadway and tracks in Denver, he appreciated the many advantages of this character of rail as well as the problems it offers when streets must be paved between the rails. Briefly he has the following to say on this subject:

"Practically all engineers in charge of street railway work are unqualifiedly in favor of the use of 'Tee' rail and where an exception occurs it is always in one of the very largest cities of the country. The only cases that have come to the author's knowledge being in New York, Philadelphia and Chicago. In these three cases the engineers all agreed that "Tee" rail was preferable in such places as the team travel was not too heavy on the track portion of the street, but that when a constant stream of vehicles was encountered on this space, a girder or grooved girder type of rail was preferable.

"One of the arguments most insisted on by those who oppose the use of 'Tee' rail is that the paving along the rail is subjected to extreme wear and ruts out with undue rapidity; now, the undue wear

on the street paving along the gage line of the 'Tee' rail is undoubtedly caused, or has been caused in the past, by inadequate methods of laying the paving abutting this point. At no other point on the street can there be any difference in wear whether the rail is 'Tee," girder, grooved girder or any other kind, providing you grant that you are not trying to create a skidway for teams in the construction of a street railway track. The increasing demand for expeditious transit in our rapidly expanding cities would seem to make the team skidway idea ridiculous.

"The paving used in conjunction with all track construction should undoubtedly be of the block or brick variety; the necessity for minor repairs to the track structure making a sheet variety of paving altogether inadvisable. It is the opinion of the author that any engineer urging the use of sheet asphalt paving in connection with street railway tracks is either inadequately educated as to the results to be obtained, wilfully oblivious to the interests of the street railway company or personally interested in the promotion of asphalt paving.

"The method of applying the paving adjacent to the gage line of the rail has been, through the development of the various types of permanent paving, the most difficult one. A prejudice has existed and in some quarters still exists in favor of a groove, either molded or cut in the blocks or bricks, and many arguments are urged in support of this method. I wish, however, to submit the fact that up to the present time it has proven anything but satisfactory. In granite, the best results are probably evident but even here the difficulty of obtaining a smooth and even cutting of the hard material is a serious objection and there is no doubt but that in vitrified brick the result is absolutely disastrous, the sharp edge of the groove wearing away at once and the life of the material at this point subjected to undue wear from the beginning. A new method of treating this gage line proposition is coming to the fore and rapidly gaining favor all over the West and Middle West. This consists simply in depressing the regular block or brick and extending it under the head of the rail at the gage line giving the paving a flat crown between the rails of the tracks. We have adopted this method in Milwaukee and find that it works very well indeed, after about four years of actual experience. It has been adopted in a number of other places with uniformly good results.

"It seems that the chief opponents of the use of 'Tee' rail in city streets are the municipal officers and other engineers in the cities where practically no experience has been had and that practically all those officers and engineers who have had anything like a comprehensive experience with this type of construction are strongly in favor of it. Proper results are often prevented thru the methods employed by the municipalities in laying the paving. I can illustrate this more clearly by telling of how this work has been done in Milwaukee. Under the laws now in force there the kind of paving to be used is finally determined thru petition of the property holders and it is a sad fact that they rarely select the type of pavement best suited to the conditions. The arguments of paving contractors, material supplymen and others are brought to bear and the result usually obtained is political and not mechanical.

"Experience shows conclusively that the use of 'Tee' rail in the permanent paving of city streets is not an experiment altho its use has been given many setbacks thru the selection of improper material and improper methods of installing the paving where 'Tee' rail tracks are laid."

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## Milwaukee's Non-Partisan Administration

The new administration of the city of Milwaukee, under Mayor G. A. Bading, has now completed a year of work and in making its budget for the coming year reviews its achievements of the past year in the light of its campaign promises.

The bill providing for non-partisan elections of city officials was introduced and endorsed by the administration and was passed.

The policy of the open door to all public business has been carried out excepting as to the printing of proceedings of the board of estimates which are tentative and subject to frequent changes.

The contest for better street car service has been sharp and was transferred to the legislature with respect to some features, with the aid of the State Railroad Commission.

A franchise for a new interurban road has been granted.

The gas inspection bureau has been re-established and the city attorney has done what was possible in the gas rate case before the railroad commission.

The tax rate for the following year will be 17 cents less than last year, it is claimed without restriction of improvements or impairment of efficiency of departments.

The administration is pushing the plans for sewage purification in the face of delays caused by contests of citizens over the location of the plants. A half million for intercepting sewers and purification tanks is introduced in the budget.

The bureau of economy and efficiency has been established on a legal basis.

Two small parks and several playground sites have been purchased.

The council presents a bill to the legislature providing that the city can bid on its own public work.

The harbor commission has been established on a legal basis and a competent secretary appointed.

HON. G. A. BADING, *Mayor Milwaukee, Wisconsin.*

Bad housing conditions have led to the condemnation and removal of one row of insanitary tenements. Child welfare work has been put in the hands of the department of health and a physician has been put in charge.

To an outsider the promises in the platform for the fulfillment of which nothing has been done seem to be of minor importance or to depend upon progress in other lines upon which work is being done.

An ordinance licensing dance halls has been passed.

By appropriating $50,000 for 800 feet of dockage on Jones Island a government appropriation of $316,000 for improvement has been secured.

Automobile apparatus has been supplied for the fire department for the first time.

Some paving by the company between street railway tracks has been secured.

Riparian rights along the lake shore for protection and parkway purposes have been obtained or are under negotiation. Plans for a new water works intake tunnel have been completed. New bridges and viaducts are completed and in prospect. One new market has been established and an appropriation has been made for the enlargement of another.

New work for 1913 and following years is outlined by the bond issues provided for, viz: $500,000 for intercepting sewers and septic tanks; $300,000 for emergency service; $900,000 for schools; $175,000 for bridges; $100,000 for park lands; $50,000 for engine house sites; $30,000 for branch libraries; $100,000 for docks and dredging; $30,000 for the new water works construction; $100,000 for municipal lighting plant; a total of $2,820,000.

Bookkeeping methods have been revised so that the condition of funds is known at all times and cost of any operation is readily obtainable. Salaries have been saved by judicious combinations of duties and reorganization of forces so as to save money in the bureau of purchases, the engineering department, the street repair work, the water waste survey, garbage collection, stone crushing, etc.

Mayor Bading may well be proud of his first year in office and sanguine of the effect of the coming year upon the voters of the city.

# QUESTION DEPARTMENT

## Effect of Gas on Asphalt Pavement

I am interested in the question of the deterioration of asphalt pavement and would like to find out if there has ever been a series of experiments made to show the effect of illuminating gas leaks upon asphalt pavement.
C., Newark, N. J.

Some desultory tests have been made by confining samples of asphalt in gas. But there have been several reports of practical observation on the subject, which demonstrate clearly the effect, for what seems to be a good reason.

In MUNICIPAL ENGINEERING there is an article on "Causes and Prevention of Defects in Asphalt Pavements" in vol. xxxvi, p. 307. In vol. xxix, p. 429, is an article which refers also to reports from Utica, N. Y., in vol. xx, p. 37; Brooklyn, N. Y., in vol. xi, p. 297; and Washington, D. C., in vol. xxi, p. 415. There is also an article in vol. xxiii, p. 212, which makes the statement, which is repeated in one or more of the other articles, that it is the hydro-carbon enrichers which produce the disintegrating effect and gas which has not been enriched has much less effect upon the pavement, or may not have any.

## Ordinance on Destruction of Weeds

Can you cite me to a good ordinance covering the subject of weeds, providing that property owners shall keep their property and vacant lots free from weeds, and also the ground adjacent to the sidewalks and to the center of the street, etc.?
B., City Attorney, ———, N. M.

The ordinance in force in a city of 250,000 population, first declares that the growth of weeds or noxious plants within the city is injurious to public health and within the limitations of the ordinance is a nuisance; and that it is unlawful for the owner of any lot or ground within the city to allow the same or any street or alley upon which said lot abuts to become overgrown with them to an extent that in the opinion of the Board of Health, is detrimental to public health and comfort.

It then provides that the sanitary officers shall make inspections from time to time and report names of owners of lots on which or on streets or alleys on which the lots abut, weeds have been permitted to grow. The board then investigates and may declare the weeds a nuisance to be abated and destroyed. Written notice is served on each owner or his agent, directing the cutting and burning of the weeds. Notice to unknown or non-resident owners is made by publication twice in two weeks. If the owners fail to observe the notice within the time set in it, ten days from time of service or last day of publication, the board must order the work done by its own employes. The board certifies the cost to the city comptroller, who places it on the tax duplicate as a lien to be collected, as are assessments for sprinkling and sweeping streets.

Failure to comply with the notice is also made a misdemeanor subject to $50 fine.

## Form of Ordinance for Public Improvement in Illinois

Last year we put in a cement sidewalk and two property owners did not build within the thirty days allowed them by the ordinance, and the city built and made the levy for the special tax thru the county collector's office, to which the said property owners filed objections. The county court overruled the objections, but our Supreme Court sustained them on the ground that the notice given them to build was between the time said ordinance was passed by city council and time of its publication. Now, we have Section 296c of Chapter 24, of our Revised Statutes of Illinois, being the last section of the sidewalk act, which provides that where tax is set aside by a court, a new ordinance may be passed, etc., for work already done, etc. Have you a model ordinance for this new ordinance for the levying of the special tax for work already done? If so, would be pleased to have a copy of it or information to draw one.
W., City Attorney, ———, Ill.

The procedure under Illinois statutes is so complicated and is so indefinitely

laid down that even the courts cannot agree about it, as demonstrated in the question.

Some years ago the National Paving Brick Manufacturers' Association, recognizing the difficulties, prepared a book of forms for all stages of the passage of a public improvement from petition to payment of assessments. Most of this book is still of use, altho some changes have been made in the statutes since it was issued. Perrhaps a copy can be obtained by addressing W. P. Blair, secretary, Locomotive Engineers' building, Cleveland, O.

## Books on Reinforced Concrete Dam and Wall Construction

Can you recommend a handbook covering reinforced concrete construction of retaining walls, dams, etc.?

W. A. S., Newnan, Ga.

Chapters in Taylor and Thompson's "Concrete Plain and Reinforced" ($5) and Buel and Hill's "Reinforced Concrete" ($5) are devoted to this subject. The former contains lists of articles in engineering periodicals descriptive of many such structures. Webb and Gibson's "Reinforced Concrete" ($1) contains a brief theoretical analysis of the reinforced concrete retaining wall. Mensch's "Reinforced Concrete Construction" ($2) has brief discussions of both forms of structure. Gillette and Hill's "Concrete Construction Methods and Cost" ($5) has brief descriptions of methods of construction.

## Earnings of Public Utility Corporation

Can you refer me to any data concerning the earnings of public utility corporations, both in this country and in other countries, particularly Europe?

I have not been able to lay my hands on any such data for Europe, except what is contained in the 1907 report of The National Civic Federation.

F., Denver, Colo.

The "Manual of Statistics" ($5), published by The Manual of Statistics Company, 20 Vesey street, New York, is an annual volume which gives more or less complete figures regarding the operation of railroad and industrial corporations, among which are many public service utilities.

Such newspapers as the following give reports from such companies as desire to sell bonds or stock: Daily, *Banker and Stockholder*, $25 a year; *Bond News*, $84; *Bond Buyer*, $120; weekly, $12; *Shareholder*, semi-weekly, $4.

Dealers in securities of such companies have access to circulars giving statements of results of operations of such companies, and distribute them among prospective investors. Such operators of public service industries as Stone & Webster, issue periodical statements of their companies for the benefit of investors.

The annual reports of the Massachusetts Gas and Electrical Commission and of the Public Service Commission of the First and Second Districts of New York, contain detailed statements of the financial operations of the public service companies under their supervision.

The special reports of "Financial Statistics of Cities of over 30,000 Population," made by the U. S. Census Bureau give total receipts and expenditures of public service industries under municipal ownership.

The "Municipal Year Book," published by Edward Lloyd, Ltd., 12 Salisbury Square, London, E. C., England, gives brief statements of capital and revenue accounts of water, gas and electric works and tramways owned and operated by municipal corporations in Great Britain and Ireland.

Will our readers refer us to other sources of the information desired, particularly with reference to other countries?

## Water Rates

I desire to obtain information relative to water rates in the United States as charged by the different cities and towns, and the water companies. I am told that you have published such information in your magazine.

A. A. F., Pittsfield, Mass.

The best collection of water rates published is that in the Manual of American Water Works, which was published in 1897, although it is somewhat out of date in respect to a good many plants. It can be obtained for $1.50.

A number of collections of water rates have been published in MUNICIPAL ENGINEERING. In vol. xlii, p. 190, is an article giving the range of water rates in Pennsylvania cities. In vol. xli, p. 131, is an article giving the water rates in a large number of the smaller cities in Indiana, Ohio and Illinois. In vol. xl, p. 103, is a general article on water rates; on p. 120 is one giving the rates for sprinklers and standpipes for fire protection; on p. 319 is an article on the principles of rate making. In vol. xxxix, p. 208, is an article giving rates in cities served by gravity systems; on p. 209 is one giving rates for laying macadam; and on p. 120 is an article giving rates in a number of Connecticut cities.

Mr. Dow R. Gwin made a collection of water rates, which was published in the Proceedings of the American Water Works Association and can be obtained from the secretary, Mr. John M. Diven, 47 State street, Troy, New York.

# WORKERS IN THE FIELD

## Cement Required for Curb, Gutter and Street Foundation

The Editor of MUNICIPAL ENGINEERING:

Sir—Having recently had occasion to estimate the amount of cement required for some paving and curbing work of various kinds, I have averaged up the daily inspectors' reports from several jobs of which I have had charge, to arrive at a practical unit of cement for each unit of work actually constructed.

As the data may be of use to some of your readers, owing to the fact that the amount of cement actually used differs materially from the amount indicated by a calculation, I submit the results, as follows:

A job of straight 6x20-inch concrete curb, built of one mix concrete, one part cement, two parts sand and as much gravel or crushed stone as could be readily bedded, used 0.2 sack of cement to each lineal foot of curb.

A job of one coat 6-inch concrete paving, one part cement, two parts sand and four parts crushed stone, used 0.985 sack cement to each square yard.

A job of combined curb and gutter, consisting of a 6x12-inch curb, joined to a gutter 36 inches wide, 6 inches thick at its junction with the curb and 8 inches thick at its junction with the pavement, made of one mix concrete, one part cement, two parts sand and four parts crushed stone or gravel, used 0.472 sack cement for each lineal foot.

A job of paving foundation 4 inches thick, of concrete, one part cement, three parts sand and four parts crushed stone or gravel, used 0.518 sack cement to the square yard.

A job of combined curb and gutter, consisting of a 6x12-inch curb, joined to a gutter 36 inches wide and 6 inches thick, made of one mix concrete, one part cement, two parts sand and four parts gravel or crushed stone, used 0.46 sack cement per foot.

Another job of paving foundation, 4 inches thick, under same specifications as above, used 0.46 sack cement to a yard.

THEO. S. DELAY, C. E.,
Creston, Ia.

## Eugene, Ore., Municipal Light and Water Plant

*By Alvin Meyers, Electrical Engineer.*

The past year has seen the completion of the municipal street lighting system, and large extensions of the municipal water system. The city of Eugene now has over half a million dollars invested in these public utilities, and is serving the whole city with water and with electrical power and light.

The generators, water wheels, switchboards, and step-up transformers are housed in the main building, which is of corrugated iron 90 feet by 40 feet. The main line circuit breaker and the arresters are located in a separate high-tension room, 24 feet by 36 feet, just back of the switchboard. Foundations are of concrete, 24 feet deep, in a gravel and rock formation, and are adapted to the reception of a brick building later.

The generating plant consists of two units, each made up of a 1,200-b.h.p. Pelton-Francis type turbine, direct connected to a 2,300-volt, 60 cycle, 3 phase Fort Wayne alternator, having a normal rating of 945 h.p. (705 k.v.a. at 300 r.p.m.). Each generator has an overload capacity of 25 per cent or 1,180 h.p. (875 k.v.a.) for 2 hours.

With the addition of another bank of transformers the maximum continuous capacity will be 2,000 h.p. at the generator terminals.

Two 40 h.p. (30-kw.) Ft. Wayne exciters are in operation, each one belted to the shaft of its respective generator. The hydraulic head on the shaft centers of the wheels is 28 feet, and the draft head is 15 feet, giving a total head of 43 feet.

At the close of construction each unit was tested out separately to the capacity of approximately 1,000 h.p. on artificial loads. While the tests were in progress, switchboard readings, smooth operation of the machines and freedom from heating indicated that the guaranteed performance and efficiencies of the manufacturers had been satisfactorily met.

The maximum load on the station in October, 1912, during various times

reached 550 h.p. This means that in ten months of commercial operation over ¼ of the ultimate, and about ½ of the present station capacity, has been used.

The power distributed from the city substation is used for pumping city water, street lighting, and commercial light and power service.

For pumping the power is delivered at 2,300 volts to an adjacent building, where the pumps for the city water works are located.

The street lighting equipment is located at the substation. It consists of two 20-h.p. (16-kw.) 6.6-ampere regulators, which operate the street lights through two circuits. One circuit covers the north and west portion of the city, while the other circuit furnishes the south and east portion. This arrangeemnt permits of continuous extensions which are in progress, the first plan being to cover the city with at least one 100-watt series tungsten lamp at every block corner. Thirty miles of streets are now lighted by this system. The lamps are usually mounted by means of pipe brackets on poles at the street intersections and at a height of about 15 feet above the curb.

The commercial service is furnished by two 2,300-volt, three-phase circuits, carried overhead on poles. The circuit for the north and west and business section of the city is of No. 0 copper with a load center at about 3,000 feet from the substation. The circuit for the south and east part of the city leaves the substation underground for a distance of 500 feet, and then changes to overhead construction. The standard secondary voltages are 230 volts three-phase for motor service, and 230-115 volts for lighting service.

Customers' service is metered thruout excepting such service as is fixed in regard to the amount and hours of use, as in case of sign and window lighting.

The lighting of the business section with ornamental cluster lights is now in process of installation. Five-light posts are used with four pendant 60-watt tungsten lamps, and one vertical 100-watt lamp. Pendant lamps are enclosed in 12-inch roughed glass globes, and are turned out at midnight. The vertical lamps are enclosed in 14-inch glass and burn all night. Energy is furnished from the 230-115 volt three-wire commercial system. The wires are carried in steel conduit laid in the cement walk next to the curb.

The subject of reduction in rates caused by the municipal electric plant entering the field has been touched upon. Again briefly stated, this reduction has benefited the city of Eugene, but the neighboring city of Springfield has reaped some of the fruits of reduced rates to a partial extent. In the city of Eugene, where heretofore the maximum lighting charge was 15c per kilowatt hour, the maximum rate now charged is 9c per kilowatt hour. In other words, when the city plant entered the commercial field just a year ago the maximum lighting rate published by the city was the 9c rate above referred to. The corporation furnishing electrical energy in the city of Eugene finally met the city's rate, after three separate and distinct reductions.

It is perhaps not generally understood by the average citizen what patronage means in reducing the unit cost of the production of electrical energy. The fact is well recognized, that a large number of kilowatt hours can be produced at the same cost as a small number of kilowatt hours. Hence the cost per kilowatt hour reduces rapidly with increased patronage.

Loyal support and constantly growing patronage will have only one result, that is, cheaper cost per unit, and as patronage increases consequent further reduction in rates is the inevitable result. The rates for consumption of electrical energy, as shown herewith, are the result of careful consideration of all the problems pertaining to rate making.

SCHEDULE OF RATES FOR POWER AND LIGHTING SERVICE AS ADOPTED BY THE EUGENE WATER BOARD.

*Lighting Service.*

| | Cts. per kw. hr. |
|---|---|
| 20 kilowatt hours | 9.0 |
| 40 kilowatt hours | 8.0 |
| 100 kilowatt hours | 7.0 |
| 230 kilowatt hours | 6.0 |
| 500 kilowatt hours | 5.0 |
| 1,300 kilowatt hours | 3.0 |

Intermediate kilowatt hours at intermediate rates. Minimum monthly bill, $1.

*Power Service.*

| | |
|---|---|
| 100 kilowatt hours | 5.0 |
| 150 kilowatt hours | 4.5 |
| 230 kilowatt hours | 4.0 |
| 380 kilowatt hours | 3.5 |
| 800 kilowatt hours | 3.0 |
| 1,300 kilowatt hours | 2.75 |
| 1,900 kilowatt hours | 2.50 |
| 5,000 kilowatt hours | 2.25 |
| 10,000 kilowatt hours | 2.0 |

Minimum monthly bill. 75 cents per horsepower of maximum demand.

## Conservation of Water Resources For Inland Navigation

*By Albert H. Scherzer, Chicago, Illinois*

The national wealth of the United States during the time of the first President was less than $1,000,000,000, yet sufficient for the defense of the United States. The national wealth had increased to about $10,000,000,000 in 1850, to $16,000,000,000 in 1860. The public debt then was less than $60,000,000, and the population had grown to nearly 32,000,000.

During the period from 1861 to 1865 more than 2,000,000 men were employed in military service, requiring salaries and expenses about $3,000,000,000, nearly 20 per cent. of the national wealth. One million lives were sacrificed. The expenditures, including interest and pensions up to 1913, were more than $16,000,000,000. To this should be added the property devastated and the limitation in production for a number of years.

These facts are stated here to illustrate the great cost of war and the great financial strength of a comparatively small population 50 years ago, in order to form a conception of the very great financial strength of the United States Government at the present time for constructive work in the line of its duty for the welfare of the people.

### Valuable Private Constructive Work

The greatest visible construction work for the welfare of the people has been performed by private enterprise in building the railways on which about $16,000,000,000 has been expended, less than the cost of the Civil War, but the construction of the railways aided the United States to recover more quickly from the destruction between 1861 and 1865, so that today, after nearly 50 years of united upbuilding, the obligations of the Government remaining are virtually confined to the pensions.

The national wealth now exceeds $130,000,000,000. To this must be added the energy represented by 95,000,000 united intelligent people. No government has ever had so great an accumulation of natural resources, intelligence and financial energy at its command. There is now no desire of the people and, in fact, no opportunity to direct the great money energy of the Government into expensive warfare with any nation.

If only 1 per cent of the national wealth, $1,250,000,000, is expended during the next ten years in construction work by the United States Government for the welfare of the people, the beneficial results will endure for centuries and be clearly apparent to the people. If 20 per cent of the national wealth could be appropriated 50 years ago in hazardous and destructive warfare, 20 per cent. of the national wealth can be safely appropriated during the next 20 years for purposes of construction and only result in a very great increase of the national wealth and public welfare.

### Federal Constructive Duties

In the life of a nation it may be necessary to have a brief time of destruction or warfare, but the greater part of a modern nation's life should be employed in constructive work.

The Federal Government has constructive obligations to perform as well as the smaller organizations, the municipalities, counties and states. Everywhere we see the wonderful constructive activity of the individual citizen exhibited in the improvements of lands, construction of homes and multitudes of other constructive works. The same is true of many private corporations who exhibit a great and ever-increasing constructive activity for the welfare of the citizen.

### Cities Have High Constructive Record

Municipalities governed by a mayor and aldermen with limited powers are obtaining revenue by various forms of taxes and in many cases devoting more than 90 per cent. of the revenue collected for constructive work for the direct welfare of the people.

Municipalities in the United States annually appropriate large sums for schools and schoolhouses, water works, sewers, improved streets, parks, electric lights, libraries and many other beneficial constructive work. Undoubtedly perfection has not yet been reached either in the intricate municipal taxation levies or in the expenditure of the revenue collected, but the results visible everywhere from having developed a definite constructive purpose and system for the welfare of the taxpayer are very surprising when contrasted with the comparatively small visible results now received by the people from their greatest constructive organization and center of monetary wealth, the Federal Government.

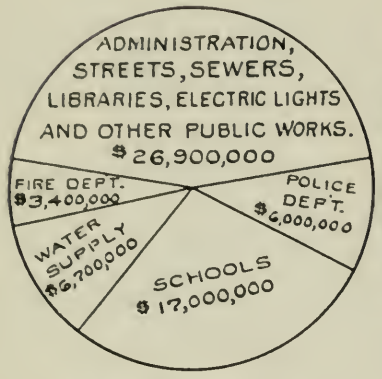
### Federal Constructive Record Undeveloped

Only about 14 per cent of the more than $600,000,000 taxes annually raised by the Federal Government is devoted to construction, including the Panama Canal. About 70 per cent. goes to the three items, army, navy and pensions. The postoffice being virtually a self-supporting business is not included in these items. Within a year the Panama Canal will be finished and unless some plan for constructive work is ready the percentage devoted to construction will become still less. Here is a great opportunity for improvement to benefit the entire people. No city or state has at its service as great ability as the

Three Records Compared

**The Good Citizen's Record**

The good citizen's record averages about 70 to 90% constructive




**A Typical City's Record**

Annual taxes of $60,000,000 expended principally for constructive purposes.

City, County and State authorities average about 70 to 90% constructive for the welfare of the taxpayer.

Mayor and aldermen or city authorities have a limited constructive opportunity and revenue, but in modern times have developed a comparatively high constructive record.

**The Federal Record**

Constructive record only about 14% of the more than $600,000,000 annual taxes.

The Federal Government represents 95,000,000 people and the national wealth of more than $130,000,000,000.

The President, Senators and Congressmen have great ability, a large constructive opportunity and great money resources to be used for construction.

The Panama Canal will be completed in 1913 and if no comprehensive constructive plan is ready the constructive record may be much less than 14%.

United States Government. Ability, energy and money can be directed either toward construction or destruction.

Intricate local taxation and tariff questions requiring discussion and adjustment do not suspend municipal improvements and tariff discussions should not suspend plans for Federal improvements. The amount a modern government appropriates for constructive work should greatly exceed the amount it appropriates for destructive purposes. If the Federal Government expends only a part of the energy during the next 50 years in constructive work that it expended 50 years ago on work necessarily involving destruction, many lives will be saved and the direct returns and benefits to the people will be very great and permanent.

### Water the Great National Property

The principal constructive duties entrusted to the United States Government are those relating to the improvement of the great rivers and harbors of the United States for maximum service and usefulness. The rivers represent great rights of way covered by water, one of the most valuable, useful materials in the world, but when not confined to definite, useful channels water becomes very destructive and wasteful to life and property. The control of the Mississippi and other great rivers of the United States is a primary Federal duty, as these rivers extend thru many states and carry interstate, international and intercontinental commerce. The Federal Government alone has the authority, money resources and ability at its command for the proper construction of these great works entrusted to it by the people.

The deepening, straightening, improvement and regulating the outflow of the great rivers of the United States to obtain their maximum service for the benefit of the people will more than double the present national wealth of $130,000,000,000, and the cost of performing this work will be but a small fraction of the direct financial returns.

### Control Not More Difficult Than Building Large City Waterworks System

The active performance of this duty by the United States Government is no more difficult than it is for a city to build an adequate useful water works system for the benefit of its citizens and at the same time construct improved streets, schools and many other public works for the public welfare.. If cities can do so much for the public welfare it is evident the improvement of the great rivers and harbors of the United States need only employ a comparatively small part of the constructive energy, ability and vast money resources entrusted to the United States Government. Using a comparatively small part of the great money energy of the Federal Government to control and develop the great National property, water, for maximum usefulness will more than double the National wealth, the wealth of individuals and corporations.

## Road Building in Michigan

*By J. B. McArthur, Road Commissioner Sheboygan County, Sheboygan, Mich.*

Jurisdiction over county roads in the state of Michigan is vested in the boards of county supervisors of the respective counties, and jurisdiction over township roads is vested in the commissioners of highways of the respective townships. The board of supervisors of any county may submit the question of adopting the county road system to the electors of said county and if same is adopted a board of county road commissioners consisting of three members shall be elected by the people of the county to have jurisdiction over all road matters in said county.

The commissioners of highways of each township may levy annually for highway purposes, a road repair tax of not to exceed 50 cents on each $100 of assessed valuation, and a tax for highway improvements of not to exceed 50 cents on each $100 of assessed valuation, the rate of levy to be fixed by the electors at the annual township meeting. On a vote of 60 per cent. of the legal voters of a township, the township board may issue bonds for road purposes not to exceed 5 per cent. of the assessed property valuation in the township.

In the counties adopting the county road system, a tax for road purposes may be levied by the county road commissioners of not to exceed 2 mills on each $1 of valuation. Such counties may issue bonds not to exceed 3 per cent. of their taxable valuation.

We have constructed considerable water bonded macadam and gravel roads. In 1912 we constructed several miles of stone and gravel roads and during 1913 will probably build considerably more of this type than we have ever laid in previous years.

There is no doubt but that gravel roads comprise more than 90 per cent. of the total mileage in the United States and it is quite important that they not only be efficiently and economically constructed but that they be maintained in good condition and at the smallest possible expense for travel at all seasons of the year.

Roads of the above type must be well drained and properly crowned in order to be serviceable at all times. In order to be properly drained they must have the proper longitudinal grade; a minimum grade of 0.5 per cent., with a maximum grade of 5.0 per cent., which may be increased, depending upon the amount of traffic and the obstacles met in locating. The minimum grade is necessary in order to give the side ditches the proper amount of fall to carry the water quickly and rapidly along and away from the road. The side ditches should be built of a sufficient width to carry successfully all of the water coming into them, having side slopes of 1½ horizontal to 1 foot vertical, which will prevent the earth from the side caving in either from excessively wet weather, or from freezing and thawing.

Among the many things extremely vital to the building of highways are improved methods and better machinery for doing the work. The engineer and public works official are interested in this part of the subject, entirely from the viewpoint of obtaining lower prices for their work; the contractor in order to make

PORT HURON TRACTOR *and train of Dump cars in use on Michigan roads.*

profit, which being increased, means lower prices on subsequent work. Thus the incentive of each means a saving to the taxpayer, more roads for the same money.

The spreading dump wagon should be more generally used because it materially decreases the cost of spreading stone and makes it possible to do the work in much quicker time and for considerably less money. We own and operate twelve Port Huron spreading wagons which evenly spread and distribute the material. Compared with self-dumping and non-spreading dump wagons these machines save in spreading alone 2 to 3 cents a cubic yard and as compared with shoveling from the wagon they effect a saving of about 5 cents per cubic yard. The material is not only evenly distributed but it is placed at the exact spot required.

In our work we operate aside from the twelve spreading wagons, two traction engines, six dump wagons and two water wagons, all of the Port Huron type. In order to carry on the work most successfully, this spring we contemplate purchasing a traction engine as well as a combination tractor and roller.

THE EMERGENCY SQUAD *with motor transportation repairing a road in Shelby County, Tennessee.*

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## Repairing Roads with Emergency Squad

*By Thos. B. King, Chairman Shelby County Road Commissioners, Memphis, Tenn.*

Following the lead of the City of Memphis, Shelby county shook off the shackles of an antiquated and inadequate form of government and inaugurated Commission Government last year.

The commission meets on the first Thursday of each month. All meetings are public and everyone is always cordially invited to attend these meetings, including all called meetings. While the commission is in session almost daily, the public can always find one, and most of the time three commissioners in their office in the court house.

There are now 626 miles of pikes in Shelby County and 700 miles of dirt roads which have been graded and worked under a special act of the legislature, making a total mileage of what may be called public roads far in excess of the average county, not only in this state, but in any other state in the South.

The accompanying picture shows the emergency squad of the workhouse at work on the roads in Shelby county.

The duty of this squad is to repair the most needed places in the turnpikes and to replace small bridges and culverts that have been washed out by late rains.

The county owns the truck, and each day the superintendent, under the direction of the commissioners, sends this emergency squad to open ditches, to repair the most needed places and to travel over different roads in search of the bad washes and broken-in culverts with instructions to repair as they go.

This is rather a new feature in road repairing, and is thought by the commissioners that it will be enlarged until much of the repair work will be done in this manner.

# ROADS AND PAVEMENTS

## Congestion of Traffic on Fifth Avenue, New York

The Fifth Avenue Association made a special study in December of the traffic conditions on the avenue between 27th and 49th streets, and at the crossings of 27th, 32d, 34th, 42d and 45th streets. The study was limited to the hours of greatest congestion, 2 to 6 p. m., and was made the basis for recommendations of ordinance provisions for the regulation of traffic on the avenue and of suggestions for handling traffic at the street intersections.

The traffic census and the study of management were made by J. Bernstein, C. E., under the direction of the officers of the association, of which Robert Grier Cooke is president.

The census was made with special reference to the problems of handling traffic at street intersections and along curbs and took account of passenger and business vehicles, motor-driven and horse-drawn vehicles, omnibuses, heavy trucks and light vehicles, northbound and southbound on Fifth avenue, and turns to the left, on the first day. Later counts were made of the passages of hacks cruising around looking for fares, of empty vehicles and of the times traffic was halted at street crossings and average time lost, and at two places the number of turns of vehicles in the middle of a block were counted. Similar counts were made on one day each at the principal cross streets above named.

The following table gives the totals at each of the points of observation, which were located in each case on Fifth avenue, between the street named and the next street north; the first column giving the total movement of vehicles each way, the second and third the movement of passenger vehicles, in the second, northbound and the third southbound, and the fourth and fifth the movement of business or freight transfer vehicles, in the fourth northbound and in the fifth southbound.

*Movement of Traffic on Fifth Avenue, New York.*

| | Total Both Ways | Passenger Vehicles | | Business Vehicles | |
|---|---|---|---|---|---|
| | | North Bound | South Bound | North Bound | South Bound |
| 27th .. | 5,123 | 2,817 | 2,129 | 66 | 71 |
| 32d ... | 6,362 | 3,493 | 2,653 | 78 | 138 |
| 34th .. | 6,978 | 3,913 | 2,759 | 150 | 156 |
| 36th .. | 6,372 | 3,214 | 2,942 | 91 | 125 |
| 42d ... | 9,229 | 4,620 | 4,184 | 134 | 291 |
| 44th .. | 8,463 | 4,383 | 3,835 | 93 | 152 |
| 45th .. | 10,048 | 5,167 | 4,621 | 70 | 190 |
| 47th .. | 8,619 | 4,630 | 3,597 | 158 | 234 |
| 48th .. | 8,224 | 4,343 | 3,363 | 257 | 261 |

It is evident that the number of business vehicles is comparatively small, but the omnibuses are included in the passenger vehicles.

Motor-driven vehicles almost equal the number of passenger vehicles, being usually between 300 and 400 less running north, and between 200 and 300 less running south, except above 47th and 48th streets, where they are less than 100 apart in each direction.

The number of omnibuses ranges from 110 each way above 27th street, to 182 above 47th and 48th streets. The number of heavy trucks varies from 10 each way above 27th street to 182 northbound and 132 southbound above 48th street, the southbound trucks being in the majority except at the stations farthest north and farthest south. The number of light vehicles counted at each station is very nearly that of passenger vehicles, being usually much less than a hundred smaller.

Turns to the left, that is, so that the vehicle must cross the stream of traffic, were counted. They vary during the afternoon from 281 to 52, the turns from the side streets on to the avenue being materially the larger in number, except at the stations above 27th, 32d and 44th, where the difference the other way is very pronounced.

Empty vehicles were counted at about

half the stations and averaged nearly 300 per hour in both directions, nearly two-thirds of them being southbound.

Traffic was halted on the avenue from 23 to 48 times per hour for an average of 22 to 73 seconds each time. The longest stoppages were for the 34th street crossing, averaging more than one minute for each stoppage thruout the afternoon. Those at other crossings averaged not far from a half minute each.

The hourly variation of the traffic was considerable. In most cases it was greatest between 3 and 4, but for stations below 35th street the maximum was between 4 and 5 o'clock.

Travel across Fifth avenue at the cross streets named is ordinarily less than one-third that along the avenue at the same points, running less than one-fifth at 45th street, where the north and south traffic was the maximum observed. Traffic is held up much more seriously, however, the delays averaging much more than one minute for each stoppage and approaching two minutes in two hours at two crossings.

These observations, the general evidence of which, only, is given here, have led Mr. Bernstein and the Fifth Avenue Association to make several recommendations, which have to do with the several smaller classes of vehicles named above, the observations having demonstrated that these small percentages of the total numbers produce a large part of the congestion.

Thus business vehicles, while sometimes less than 1 per cent. of the total traffic, but occasionally as much as 11 per cent. of it, produce by their presence a cause of delay which is out of all proportion to their number. It is proposed, therefore, to keep business vehicles off the avenue between 2 and 6 p. m., except on the block on which such business wagon must make an emergency delivery. Heavy trucks loaded with building materials, coal, furniture, etc., are included in this list.

The empty vehicles going south are notable in the observations, mainly chauffeurs going for their employers, and they should be turned to parallel streets. Likewise public hack drivers should not be permitted to cruise up and down the street with empty vehicles but should be given stands on side streets.

Empty carriages and motors at the curb seriously delay traffic, because they interfere with the receipt and discharge of passengers by the omnibuses. A recommendation similar to the Birmingham ordinance is made; that 25 feet of the curb at northeast and southwest corners be kept clear so that the omnibuses can exchange passengers at the curb. Also drivers should be required to take empty vehicles to side streets while waiting for their passengers.

Turns in the middle of the block should be prohibited.

The stoppages of avenue and street traffic should be timed in proportion to the amount of traffic.

One interesting recommendation is for a simultaneous movement of traffic for six or eight blocks by means of mounted policemen whose signals could be seen by three or four corner men each way. The operation of this recommendation would seem to promise too great delay of cross traffic and a serious demand would then arise for some such separation of traffic at congested crossings like 42d street by means of partial elevation and depression of the streets to separate the grades at their crossings, as has been suggested and illustrated in the local newspapers.

The report gives the Fifth avenue side of the case and the side of the cross street traffic must be considered before final action is taken.

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## Why Some Bridges Fail

The March floods in Indiana and Ohio thoroly tested the methods of planning and building bridges, showed the weak spots and the economy of full allowance for the maximum floods in providing waterway thru the bridges. The accompanying photographs show so clearly some of the defects in design which resulted in failure that but little additional comment is necessary.

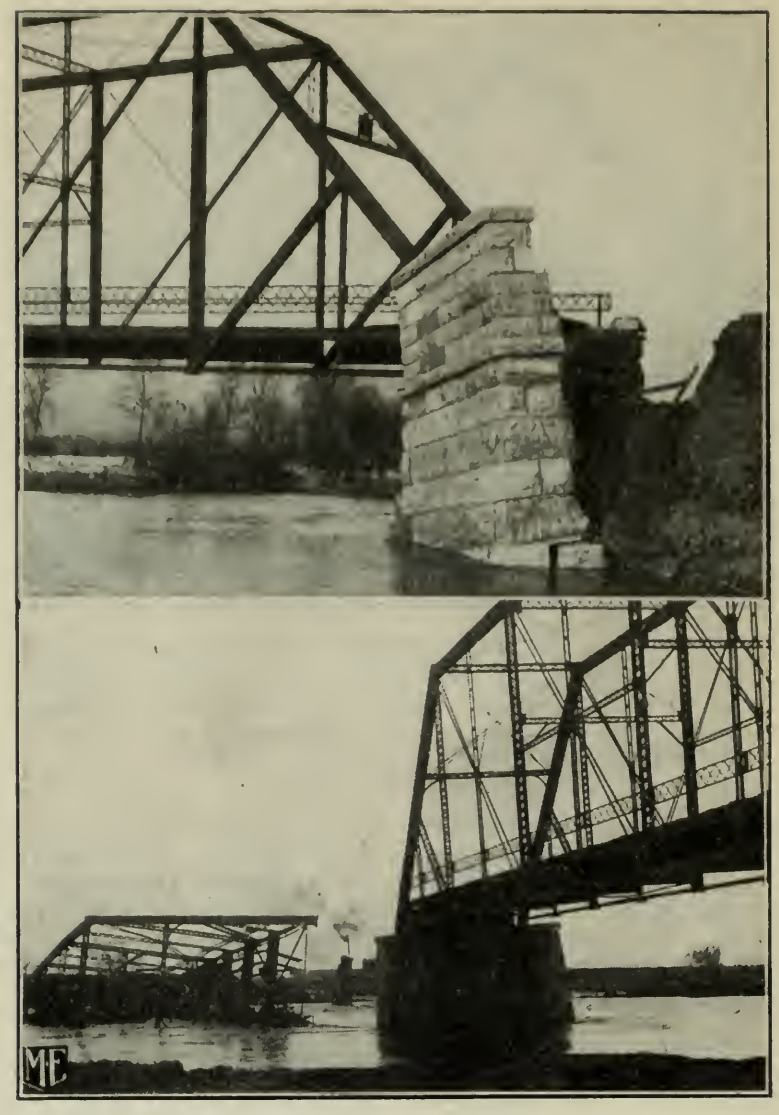
The photographs of the Meridian street bridge on pp. 24 and 64 of the April number, show the serious effects of narrowing the channel so as to reduce the horizontal dimension of the cross-section. This bridge of three spans was barely sufficient to carry the water coming to it, as shown by one photograph taken before the flood had quite reached its height. The access of the water to the south (left hand) span was restricted by the construction of the boulevard retaining wall shown in another photograph, which caused a difference of level between the water in this span and the others enough to concentrate a scouring flow in the constricted area. The horizontal dimension being short the water attempted to increase the vertical dimension to compensate. The result was the undermining of the first pier from the south for nearly half its length. When the tree seen in part in two of the photographs struck the pier, this action was increased and the pier slid into the excavation, breaking in two as seen. The arches were of concrete reinforced on the earlier Melan plan with steel I-beams and there was no transverse reinforcement. Consequently the concrete sheared off neatly along a

KENTUCKY AVENUE BRIDGE, *Indianapolis, over White river, after the flood. Fill behind abutment and street pavement washed out and abutment undermined and damaged. Note strength of pavement of street railway tracks.*

reinforcing beam on the line between the solid and the moved parts of the pier, leaving the lower half of the bridge in as good condition as it had ever been. The retaining wall was also undermined to some extent, only the lower portions of it, with insufficient foundation, dropping into the creek. These parts were located above the constriction of channel. The gravel washed from the bed of the stream was deposited under and just below the bridge arches, where the current was reduced in velocity by the increase in width of cross-section and the discharge could be taken care of by the wider and shallower form of cross-section. This is seen in the accompanying photograph which shows the debris from the arch deposited in and on the gravel bank formed underneath it. The twisted I-beam shows how the arch revolved about the attachments to the piers, the crown turning bottom upwards next to the face.

The Washington street bridge is an instance of the use of a deck girder instead of a thru girder for the convenience of the travel over the bridge, which resulted at highest flood stage in an approach to a dam across the river with insufficient flood gates open thru it. When debris

MERIDIAN STREET BRIDGE, *Indianapolis, over Fall creek, after the flood. Preparing to remove the damaged section. Note twist in some of the I-beam reinforcement of arch, also gravel and debris deposited under bridge.*



HARDING STREET BRIDGE, *Indianapolis, after the flood. Lack of wing walls and insufficient foundation for abutment.*

RAYMOND STREET BRIDGE, *Indianapolis, after the flood. Insufficient foundations for piers and abutments; no wing walls.*

landed against the bridge and still further restricted the discharge under the bridge, the structure was pushed out of place, carrying all of two piers and part of a third with it. Only one span, at the west end out of the maximum flow of the current, remains. A sharp bend of the river, at this place, which threw the current against the east bank and caused an eddy on the lower side of the bridge added to the destructive effect. This is indicated and the increasing tendency to scour toward the east end (left foreground) is shown by the difference in level of the water on the west and east sides of each pier.

Three of the bridges shown are old steel girder bridges built twenty or more years ago. They show the defects of many bridges built too cheaply, in insufficient foundations of piers as in the Raymond street bridge; absence of wing walls and lack of protection of abutments against scour as in the Harding street and Kentucky avenue bridges. The current got behind the abutments in each of these bridges and damaged them tho it did not destroy them. The strength of the street railway track is shown in the picture of the Kentucky avenue bridge. The fastening of the rails to the ties, the strength of the tie rods between rails holding the pavement between the rail flanges, and the adherence of concrete and cement filler to ties and rails, has kept the pavement, including the concrete foundation intact, so far as the street railway company's part is concerned, tho

the pavement of the remainder of the street at this point has disappeared.

The Thirtieth street bridge at Riverside Park and across White river did not fail. Much water passed round this bridge on both sides and it is possible that it could not have carried all of the discharge of the river, but it stood the pressure to which it was actually subjected without injury. Wing walls, abutments and foundations were ample in this modern reinforced concrete arch bridge.

WASHINGTON STREET BRIDGE, *Indianapolis, over White river, before the flood reached its height. Note differences of elevation between two sides of each pier, caused by bend in stream throwing current to east bank and impossibility of making piers conform to current direction thruout.*

## Standard of Abrasion for Paving Brick

The organizations of city officials interested in standardizing paving specifications adopted a standard rattler for making abrasion tests and standard methods of making the tests but did not see fit to specify the maximum allowable amount of abrasion until a year or so ago. After two or three trials the specification has been set at 22 per cent. with proviso in the specifications of the American Society of Municipal Improvements that "where medium or light traffic or other conditions exist which, in the opinion of the engineer, do not require a brick capable of giving an abrasion loss of only 22 per cent., brick of a quality which will give a loss of 25 per cent. or even 28 per cent. may be used.

A recent canvass of modern brick paving specifications shows that 22 per cent. has been adopted as the maximum allowable abrasion in Grand Rapids, Mich., Fremont, O., Fostoria, O., Akron, O., Toledo, O., Newark, N. J., Philadelphia, Pa., Sidney, O., and Bryan, O.; 21 per cent. has been adopted by Chicago, Ill., Indianapolis, Ind., Canton, O., Columbus, O., and Sandusky, O.; 20 per cent. by Trenton, N. J.; and 20 to 22 per cent. by Baltimore, Md.

## Pavements in Peoria, Illinois

*By J. B. Jeffries, City Engineer.*

During the year 1912, the city of Peoria laid more pavement than ever before in its history. One hundred and fifteen blocks, over ten miles, or one-eighth of the total extent of Peoria's paved streets.

The record in 1912 in street paving has been remarkable for three things; the practically universal adoption of the concrete foundation and cement grouting for brick paving, the rapid extension of the creosoted block paving, and the improvement of the residence streets of the city. The experience of the past years has taught the city improvement officials that the sand foundation and filling for brick paving is faulty. The street quickly turns from a smooth surface to a paving full of sink-holes and bumps. But the concrete foundation and the cement grouting, the former furnishing an absolutely level surface and the latter binding the bricks together in such a manner that the hardest rain is unable to undermine them, is a system that prevents all faults and gives a smooth surface that will last for many years.

On March 11, 1913, the city council authorized the laying of 15,000 more square yards of long leaf yellow pine creosoted wood block on Adams street. All of the creosoted wood block which we have laid thus far is southern long leaf yellow pine.

The first creosoted wood block pavement laid in this city was the improvement of South Adams street from Hamilton street to Bridge street, containing 11,500 square yards.

The street was torn up late in the fall of 1910 during the month of October; a 6-inch concrete foundation was used, a 1½-inch cushion of sand and a single layer of 3½-inch wood blocks. The size of the blocks was 3½x3¾x8 inches. They were laid diagonally across the street at an angle of 60 deg. with the center line. Longitudinal expansion joints of pitch were placed along the curbs and transversely across the street every 50 feet. The joints along the curb were 1 inch in thickness, while those across the street were ½ inch in thickness. The creosote oil used had a specific gravity of 1.10 at a temperature of 25 deg. centigrade and the blocks received a treatment of 20

ADAMS STREET, *Peoria, Ill., paved with yellow pine creosoted wood block.*

pounds to the cubic foot. Considerable criticism arose from the fact that, in the following spring and summer months, the street became a sea of tar. This was caused by the laying of the blocks in cold weather, and more pitch was left on the surface than was necessary, as it became hard before it could be spread over any great area. This objection has been entirely overcome, as the tar has rapidly disappeared, and the surface now presents a clean, dry appearance. This bleeding, to some extent, was caused by the blocks containing an excess of the creosote oil.

Liberty street from Adams to Madison streets, containing 3,400 square yards, was the next street paved with blocks. This pavement was started in the fall of 1911 and finished in the spring of 1912. The blocks were laid at right angles across the street and the expansion joints were placed as before. The specifications for the creosote oil were the same except that 18 pounds were used instead of twenty. This street has given entire satisfaction and no bleeding to any extent has been noticeable. In the summer of 1912, South Adams street was continued from Bridge to Oak street, a distance of 1,500 feet and containing 5,500 square yards, exclusive of the railway company; 3½-inch blocks were used with a treatment of 18 pounds of creosoted oil as before. The street railway company used a cement filler between the flanges of the rails, and this has prevented the buckling of the row of blocks adjacent to the rails. This strip of pavement is today the finest pavement in the city of Peoria.

This season South Adams street will be continued from Oak street to Cedar street, a distance of three-quarters of a mile, containing 10,300 square yards, exclusive of the railway company. Three and one-half-inch blocks will be used but the creosote oil specifications have been altered. The oil to be used will have a specific gravity of 1.08 to 1.10 at 38 deg. centigrade.

The blocks shall contain 16 pounds of this oil to the cubic foot and are to be laid at right angles across the street. Pitch expansion joints of 1 inch are to be used along the curb and ½ inch every 50 feet across the street.

The main objection to this class of pavement seems to be its slipperiness in damp weather, but this can be easily overcome by a light sprinkling of sharp sand. This slipperiness seems to decrease each year and I believe will finally disappear as the surface of the blocks becomes filled with

fine stones and sand. There is little or no wear to the surface of the blocks that have been down the past two seasons and the cost of maintenance is less than any class of pavement we have. They are rapidly becoming the ideal street for business property, as they are noiseless and sanitary, and property owners are becoming educated to the high qualities of this class of improvement and are demanding it in preference to any other kind.

## Cleaning Streets in St. Louis, Mo.

*James C. Travilla, Street Commissioner, City of St. Louis, Mo.*

Many different methods of cleaning streets are in use in various cities thruout the United States, but few cities have been able to determine with any degree of accuracy the comparative efficiency of street cleaning departments. We have systematized the street cleaning department in St. Louis in such manner as to know the exact cost of all the work of the department and also to maintain a high degree of efficiency.

In St. Louis we use two types of street-cleaning machines, which are manufactured by the Sanitary Street Flushing Machine Company and the St. Louis Street Cleaning Company, respectively. We are also using a number of squeegee machines with excellent results.

With the "Sanitary" flushing machines we apply a spray of water thru an aperture about 5 inches wide in a down spout at an average pressure of about 40 pounds and at an angle of about 30 degrees. All asphalt, bitulithic, granite block and wood block pavements are cleaned in this manner.

One machine cleans about 14,500 square yards in 8 hours' work, using approximately, under average pressure, 2,500 gallons per 1,000 square yards.

The average cost per 1,000 square yards is about $1.21, about 1½ cubic yards of filth being removed.

The work is done by the city by day labor, flushing machines costing $7, teams $4 and laborers $1.50 per day of 8 hours, drivers being included in cost of teams and machines.

Water is furnished free by the city plant. At commercial meter rates it would cost 8 cents per 1,000 gallons, or 20 cents per 1,000 square yards, average.

The work done by the street cleaning force includes the following lengths and areas of streets, once a week in a residence district, or about once a month if an alley:

| *Streets Cleaned—* | Miles. | Sq. Yds. |
|---|---|---|
| Asphalt | 67.27 | 1,604,251 |
| Bitulithic | 45.43 | 1,097,022 |
| Granite Block | 71.83 | 1,670,148 |
| Wood Block | 9.36 | 201,904 |
| Vitrified Brick | 171.83 | 3,731,402 |
| | 365.72 | 8,304,727 |
| *Alleys Cleaned—* | | |
| Granite Block | 8.89 | 85,325 |
| Vitrified Brick | 141.60 | 1,351,036 |
| Granitoid | 1.31 | 11,528 |
| Limestone | 57.33 | 471,177 |
| | 209.13 | 1,919,066 |

The appropriation for 1912-1913 has the following items:

$335,000 per annum for General Cleaning.
190,000 per annum for Patrol System "White Wings."
80,000 per annum for Municipal Stable (44 per cent. of appropriation for Garbage Removal).

$605,000 Total.

The city is divided into five cleaning districts in charge of district superintendents, who report to a general superintendent in charge of all the work. The district superintendents have supervision over inspectors in charge of men and machines. In the general superintendent's office is stationed a man familiar with the work, the city and the most convenient places for disposing of sweepings. The district superintendents and inspectors report by phone to him twice a day, and in addition, there are written reports received daily from the inspectors of the work done and the number of laborers, teams and machines employed. The unit of cost of the work is ascertained monthly.

The average makeup of the various gangs and the cost are given in MUNICIPAL ENGINEERING, vol. xl, p. 32, the only change being a reduction of pay of inspectors, from $3 to $2.50 a day. A street-flushing gang of fourteen men and eight vehicles with their drivers, costs $67 a day and there are nine crews. A squeegee outfit with five men and five vehicles with their drivers costs $35.50 a day. There are two crews. A machine sweeping gang of fourteen men and nine vehicles with their drivers costs $62 a day. There are five crews. There are eight hand-sweeping and scraping crews each with thirteen men and two wagons with drivers, costing $28.50 a day. There are nineteen under an inspector, with a wagon for each six. Each patrolman covers from 2,000 to 11,000 square yards, the average being 6,000 square yards.

The unit cost figures given in the article referred to still hold good and are as follows:

*Streets.*

| | Per 1,000 Sq. Yds. |
|---|---|
| Flushing | $1.00 |
| Squeegees | 0.45 |
| Machine sweeping | 0.81 |
| Hand sweeping | 1.58 |
| Patrol system | 0.25 |

No charge for water.

# FIRE AND WATER

## A Logical System of Meter Rates

*By G. D. Crain, Louisville, Ky.*

No system of rates which ignores the necessity for a fixed minimum income from every service can successfully withstand the test of commercial requirements without making the unit rate for water excessively high, thereby working a hardship on the large consumer. It is unquestionably practicable for a service charge to be so fixed as to give to the city an adequate revenue in a way independent of the water consumption, and at the same time to give the consumer some inducement to economy by charging him, in addition to the charge for "readiness to serve," only for the water which he actually uses.

A sliding scale of rates for water, giving the large consumer the advantage of a lower rate, which decreases with the amount of water used, is also objectionable, as operating unfairly to the individual consumer, and, in effect, making him carry the burden of the expense. Although from a strict commercial standpoint it is probably justifiable, on the ordinary theory that the purchaser in wholesale qualities is entitled to a reduced price, there is no apparent reason why a city should make any distinction of this sort, for, while, in fact, it costs precisely the same to be prepared to furnish water through a given sized meter to the consumer who uses but 200 gallons a day as to the one who uses 2,000 gallons, it does cost more to be prepared to furnish the quantity of water which would be normally consumed through a six-inch meter than through a ⅝-inch meter.

Logically, therefore, the difference in the kind of service required by the large and by the small consumer should be indicated by the service charge, and not by the rate; for, as a matter of justice, and certainly from the standpoint of the municipality, from which every citizen may reasonably demand the same treatment as every other citizen, the user of the minimum amount of water should not be compelled to pay any more per unit therefor than is paid by the great corporation, which consumes a relatively large percentage of the total amount daily conveyed through the mains.

Theodore A. Leisen, chief engineer and superintendent of the Louisville Water Company, a municipally-owned corporation, which supplies water for all purposes to the city of Louisville, Ky., at the rate of 25,000,000 to 30,000,000 gallons a day, from whom the opening sentence is quoted, says in the most emphatic manner that he is in favor of changing the company's present flat-rate system over to a straight meter system, with a graduated service charge based proportionately upon the size of the meter installed.

There are at present in use in the city about 3,000 meters, for the most part installed for the purpose of metering the water used by relatively large consumers, such as the railroads and other public corporations using the city service, numerous factories, and the like; and these concerns are charged a meter rate which is intended to give them some advantage by reason of their larger use of the water, while the ordinary dwelling is charged a flat annual rate based upon the number of rooms, size of lot, and number of water taps.

### Sliding Scale for Readiness-to-Serve Charge

In a convincing argument, from the standpoint of the company of which he is superintendent, in favor of metering the service, Mr. Leisen presents some interesting figures. To start with, it is, of course, necessary to provide for a system of rating which will produce a revenue sufficient for the operation of the plant, as well as for all necessary extensions and improvements, including for Louisville's plant fixed and overhead operating expenses of $190,000, production expenses, including pumpage, filtration, etc., of $110,000, and construction expenses of $200,000 more, a total of $500,000.

Inasmuch as the overhead expense item

of $190,000, which includes the expense of the administrative and revenue departments, general expenses, interest, and a 50 per cent apportionment of distribution and general operating expense, exists independently of the quantity of water sold, it logically follows that this sum should be met by a fixed income; and this, Mr. Leisen proposes should be done by a service charge on each meter installed. Taking the 32,000 services in actual use in the city, and dividing the overhead expense by this number, $5.94 is produced as the average sum which must be charged in order to take care of the fixed overhead charges.

Under the plan proposed, however, this charge would not be the same for all classes of consumers. Starting with a $6.00 charge for each ⅝-inch meter, it is suggested that the charge be $9.00 for each ¾-inch meter; $12.00 for 1-inch, $24.00 for 2-inch, and on up to $72.00 for a 6-inch meter. On this basis it would be an easy matter to produce by this service charge a sufficient revenue to meet all fixed overhead charges, and leave a safe margin in addition.

"The object in increasing the service charge in proportion to the size of the meter is twofold," says Mr. Leisen in a report on the subject. "It makes more equitable distribution of the charge, proportioning it to the service rendered; and it deters consumers from applying for a larger meter than is actually required. This "service charge" would not cover the cost of any water consumed, but would take the place of a meter rental, and serve the equivalent purpose of a 'minimum charge.' It covers the value of what is generally designated as a 'readiness to serve' charge, and being based on the proportionate amount of fixed overhead charges, is figured on logical reasoning, and is not a mere arbitrary or haphazard charge.

### Uniform Meter Rate

"With this 'service charge' established as outlined herein, the water can be furnished to every consumer at exactly the same rate, regardless of whether he uses one thousand gallons or one million gallons, and this rate can be fixed at four cents net per thousand gallons and within a few years it could probably be reduced, in which event we might claim, without fear of contradiction, that we were furnishing the cheapest water of any city in the country having similar conditions to contend with."

The system suggested, coming from an engineer who is conceded to be an authority in his field, is interesting, to say the least; and while the uniform rate proposition may meet with some criticism from those quarters where the idea is still held that the large consumer is entitled to special consideration, simply because he is large, the general question of the fairness of metering the service as against making a more or less arbitrary flat charge can hardly be seriously questioned. Even a sliding scale of rates, giving the large consumer a lower rate, is much preferable to the unscientific flat rate as long as the charge per thousand gallons to the ordinary citizen is not made unreasonably high. It would seem, however, that a graduated service charge, along the lines laid down by by Mr. Leisen, would solve the question satisfactorily, as well as logically, in most cases.

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## Drilling the Firemen

A practice tower has been erected in the yard of one of the fire stations in Los Angeles for the purpose of drilling the men and making them expert in their line of work.

All the up-to-date fire apparatus for the saving of life and property is in use. The tower is of wood, 75 feet high and 12 feet square. Windows are placed on all sides of the tower to make it as much like a real building as possible.

The fire captain directs this drill from the ground, sending four men at a time up the ladder. Each movement is timed in order to prevent confusion. Life lines as well as ladders are used in ascending and descending.

LIFE-SAVING NET *at base of practice tower for Los Angeles firemen.*

Every phase of the fireman's work that he may ever be called upon to do in case of fire is practiced, such as leaping from the different stories into the life nets and rescuing dummy figures, carrying them down the fire escape to the ground.

In this way the untrained men who enter the service soon become skilled in the work.

Two cuts show the practice tower in use and the life net ready for practice.

PRACTICE TOWER
*for firemen of Memphis, Tenn.*

Memphis, Tenn., is constructing a practice or steel training tower, to cost $3,000, for the use of the fire department. The tower will be square, constructed to represent a building of some three or four stories. There will be apertures of the size and shape of doors and windows, and a spiral stairway will lead to all parts of the tower on the inside. The accompanying sketch shows the design of the tower.

The installation of the practice tower will be but another step forward toward making the local department the most efficient in the country. Commissioner Utley is constantly formulating and carrying out plans for the betterment of the department and the results are reflected in a decrease in the ratio of fire loss in Memphis.

It is expected that the training or practice tower will prove of inestimable value to the department, especially in the training of new and inexperienced members. Ladder climbing, hose raising, wall scaling, life saving and other duties which a fire fighter is called upon to face will be practiced daily.

"It is my ambition to bring the Memphis department to a point of efficiency second to none in the United States," said Commissioner Utley, in discussing plans for the future, "and I am sure that the inauguration of a daily practice will do much in that direction. Practice towers are now in service in a number of progressive cities and wherever they have been tried increased efficiency has been the result."

PRACTICE TOWER
*for firemen of Los Angeles, Cal.*

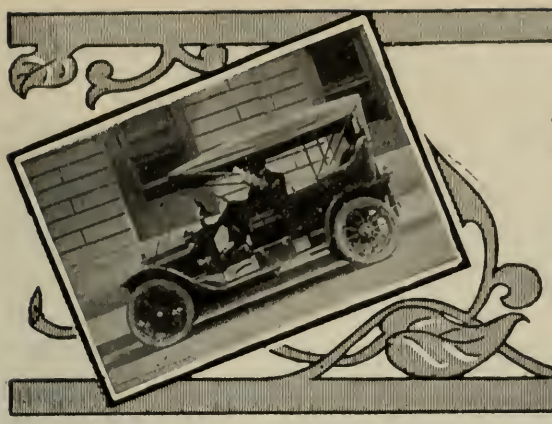
## American Water Works Association

The thirty-third annual convention will be held at West Hotel, Minneapolis, Minn., June 23-27, 1913.

The following papers are scheduled: "The Diesel Engine for Water Works," by Edward S. Cole; "Water Works Special Franchises," by Henry DeForest Baldwin; "Reforestation and General Care of Water Sheds," by Ermon M. Peck; "The Bacterial Count on Gelatin and Agar Media and its Value in Controlling the Operation of Water Purification Plants," by James M. Caird; "The Tuscaloosa, Alabama, Water Works," by Prof. Edgar B. Kay; a paper on filtration, by George W. Fuller; "Charges for Public Water Service to Private Fire Protection Systems," by W. E. Miller; "A Reasonable Basis for the Determination of Charges for Private Fire Protection," by Leonard Metcalf; "Metering Private Fire Services at Kenosha, Wisconsin," by August Baltzer; "How a Private Fire Service Polluted a Public Water Supply and Some of the Consequences," by Robert J. Thomas; "Modern Filter Practice," by Nicholas S. Hill, Jr.; "Gravity Water Supply at the City of Manila, Philippine Islands," by H. E. Keeler; "Power for Pumping Derived from Refuse," by E. H. Foster; "Pumping Engines," by L. E. Strothman; "Ground Water Supplies," by Charles B. Burdick; "Rates and Rate Making," by Halford Ericson.

On Tuesday and Thursday evenings illustrated lectures will be delivered by Edward Wegman and Dr. William P. Mason.

There will be excursions on Wednesday and Friday afternoons.



# Automobiles in Municipal Service

## The Motor Truck in the Gas Business

One of the most interesting discussions at the recent meeting of the Indiana Gas Association was on the subject of the motor truck in the distribution department. The discussion was opened by G. M. Dolley, of Logansport, who considered the conditions in a small gas plant. He does not use one because he finds that where one horse and wagon is required for the work of the department the motor truck is not economical. He thinks that the motor truck, with proper management, should do the work of two or three horses and wagons.

One essential of economical operation is a driver who can give the machine proper care and keep it in repair without the necessity of taking it to a repair garage, and gives some instructions for keeping the truck in good running order, and for spending the time when he is waiting in looking after his machine.

Overloading a truck seriously affects the economy and safety of its operation. Excessive pressure on bearings and on tires, lubrication troubles, insufficiency of brakes because of the greater inertia of the heavy load, for which the brakes were not designed, greater heating effect, are some of the reasons for prohibiting overloading which are suggested.

The driver should have some knowledge of piping and tools used so that he can often handle supplies when otherwise it would be necessary to take along one of the fitters. The truck driver can then take care of pipefitters on several jobs at the same time, keeping them supplied with materials and transferring them from one job to another. He can even serve as inspector of the work done by the fitters if competent.

As to cost of operation Mr. Dolley reported that only eight motor trucks are in use in Indiana by gas companies and only five of these could give figures of cost, only two of these being in detail.

For six months included in the reports received, the cost per mile was 2.9 cents in one case, 3.5, 9.6, 10.3 and 12.8 cents in the others. This does not include tire cost, and in but two cases are the figures given in detail. In both these cases 1-ton trucks are used. The mileage per gallon of gasoline was 9 for one and 7.8 for the other.

Fuller data are given for eleven trucks used by gas companies outside the state. In these cases the cost per mile where tire cost is not included is from 3.6 to 5 cents per mile run. Where tire cost is reported the cost of operation, including tire cost, is 1.8 to 7.4 cents a mile. In the latter case the tire expense was $116.20 for 4,246 miles run, and in the former it was $34.94 for 3,258 miles run.

The mileage per gallon of gasoline varied from 5.4 miles for a 2-cylinder, 10-h.p. car to 19.5 for a 4-cylinder, 20-h.p. car. There seems to be no relation between cost per mile, miles per gallon of gasoline, horsepower, number of cylinders or miles run. Total expense of operation bears some relation to mileage but this statement has several exceptions.

Mr. Graf, of the Indianapolis Gas Co., finds it best to send two men with each truck, who are pipe fitters as well as drivers, finding that one truck will not serve several parties satisfactorily. He finds that one truck will do from one and one-half to two times as much as a one-horse wagon. The greater ground covered is worth the difference in cost, however. A truck covers an average of 30 miles a day, in less than half the time it would take a horse, thus saving $3 to $5 a day in time of men sitting in the wagon, which must be considered in figuring the difference in cost. Mr. Graf calls attention to the fact that depreciation, interest and insurance are the most important items in the cost of motor trucks and they are not included in Mr. Dolley's figures. He assumes 25 per cent. a year depreciation, or $400 a year on a $1,600 car, and finds that liability and fire insurance cost nearly $100 a year per car, so that the total cost of operating a truck will be much more than that given in

the figures above, and will not be less than 15 to 20 cents a mile run. But even then the saving of time of men, additional work done, facility of attending to calls warrant the use of the motor.

Mr. McCleary called attention to the value of the motor truck to a company which operates in several towns, in saving of time over wagons or over interurbans when cars must be waited for or over street cars run in connection with them. He uses a truck to distribute the men to the jobs in his five towns within a radius of five miles; a meter truck, which displaced two wagons and does the work of four; and a store-room truck for making short, light deliveries. He estimates, without having the figures, that he saves from $100 to $200 a month with trucks over equivalent horse service.

Geo. D. Smith quoted the figures obtained by the Massachusetts Institute of Technology on cost of operating cars and wagons: A 1,000-pound-capacity car cost $7.75 a day for 40 miles possible travel of an electric car; $9.23 a day for 80 miles of a gasoline car, and $5.90 a day for 30 miles of a two-horse wagon. The actual average mileage covered was 35 for the electric, 38 for the gasoline and 25 for the horse, including in the average the days when cars or wagons are laid up for repairs.

The Institute's figures for cost of running an electric truck 10,000 miles in a year were given as $2,152, allowing 10 per cent. interest on $2,200 cost of a car of 1,000 pounds capacity, current $160, garage $200, driver $710, used for 285 days, all of which figures seem to be above the usual averages.

## Denver Motorcycle Squad

*By Felix O'Neill, Chief of Police, Denver, Colorado*

The Denver police motor squad, numbering eight, is stationed at fire houses in the outlying districts, and is subject to call at all hours, day and night. There are two men at each fire house, one on duty all the time.

The motor officers receive their calls at the fire houses, and are not supposed to leave during their hours on duty, except on hold-up or burglary calls.

We have two motorcycle officers who work on violation of the speed ordinance and stolen machines alone. We also have an emergency motorcycle officer, stationed at headquarters, who replies to nothing but emergency calls.

## Cost of Operating Motor Trucks

In the May number of *Power Wagon*, published in Chicago, will appear an article by R. W. Hutchinson, Jr., on "The Motor Truck in Engineering and Contracting Industries," from advance copy of which the following data are taken concerning the actual cost of operating motor trucks, the resulting unit costs having been computed from the data given in the paper.

### Labor Cost.

The Keystone State Construction Company hauls 4½ tons of coal on each of two Mack trucks from the railroad to the Hill View reservoir site at Yonkers, a round trip of 5 miles, returning empty, 8 hours a day, 300 days a year, 6 loads a day. Coal is shoveled from car to truck and from truck to shed. The driver is paid $3.50 a day and three helpers at $1.60 each travel back and forth on each truck to load and unload. The total labor cost is therefore $8.30 for 27 tons a day and 30 miles of travel.

The labor cost per ton of coal delivered is the total labor cost per day divided by 27 tons or 30.74 cents. It is hauled 2⅛ miles, so that the cost per ton-mile is 12.3 cents.

A Saurer 6½-ton dump truck is in the same service, averaging 7 tons per load and has a driver at $3.50 and 4 men at $1.60, three of whom remain at the coal cars and help load the Mack trucks. Charging all the time of the 4 helpers to the Saurer truck it costs $9.90 a day for 6 loads or 42 tons and 30 miles travel per day.

THE MOTORCYCLE SQUAD, *Department of Police, Peoria, Ill.*

The labor cost per ton of coal delivered is 23.57 cents and per mile the coal is hauled is 9.43 cents.

The consumption of gasoline for two Mack trucks and one Saurer truck is 12 to 15 gallons a day.

### Total Cost Per Ton Mile.

Henry Hanlein & Sons operated a 6½-ton Saurer truck 5,728 miles in 200 working days, an average of 28.6 miles a day, loaded to capacity one way and empty the other. The investment was $6,250.

Interest at 6 per cent., depreciation on $5,842, not including tires, at 10 per cent., insurance of all kinds at 5 per cent, and driver at $936, made the

| | |
|---|---|
| Fixed charges | $2,185.20 |
| Maintenance and repairs | 59.38 |
| Gasoline | 236.43 |
| Tires at 5.1c per mile | 292.13 |
| Oil | 85.70 |
| Total cost per year | $2,858.89 |
| Total cost per day | 14.2' |

Total cost per ton-mile, 6½ tons, 14.3 miles (one way), 15.3 cents.

### Comparison With Team Cost

Hook & Ford ran a week's test, hauling stone from their Dickeyville quarry for road building. The team made 9 miles on a round trip and the truck 10 miles on account of a weak bridge on the shorter route. One mile of the trip loaded was up a 14 per cent. grade. Average consumption of gasoline was 21 gallons, of oil 2 gallons; average hours of work 10; average loading time 3 minutes; unloading time 10 minutes; spreading stone over the road 1 minute; number of trips 6; total mileage 60; total loads 60,000 pounds; all per day. Three rainy days kept the roads soft and in bad condition for the truck. From the data Mr. Hutchinson prepared the following:

MULE TEAM.

| | |
|---|---|
| Investment: | |
| 4 mules at $325 | $1,300.00 |
| Harness | 75.00 |
| Wagon | 250.00 |
| Total | $1,625.00 |
| Fixed Charges: | |
| Interest on one-half investment at 6 per cent | 48.75 |
| Insurance on team | 32.50 |
| Depreciation, 20 per cent | 325.00 |
| Total, per year | $ 406.25 |
| Per day (225 working days) | 1.85 |
| Daily Operating Cost: | |
| Wages | $ 1.84 |
| Feeding at 60c | 2.40 |
| Stable man | .25 |
| Doctor | .20 |
| Shoeing | .30 |
| Repairs | .20 |
| Feeding 140 days idle time per year on account of cold weather, $224, or | .99 |
| Total | $ 6.18 |
| Adding fixed charges | $ 8.03 |

The team hauled 13½ tons an average of 4½ miles of 57.37 ton-miles per day, costing, therefore, 13.9 cents per ton mile.

MOTOR TRUCK.

| | |
|---|---|
| Investment | $5,300.00 |
| Fixed Charges: | |
| Interest on one-half investment at 6 per cent | 159.00 |
| Insurance, 2½ per cent. on 80 per cent. of one-half value | 53.00 |
| Depreciation, 10 per cent, not including tires | 480.00 |
| Total | $ 692.00 |
| Per day (225 working days) | 3.07 |
| Daily Operating Cost: | |
| Wages | $ 2.50 |
| Maintenance, 4½c a mile | 2.70 |
| Tires, 6c a mile | 3.60 |
| Gasoline, 4c a mile | 2.40 |
| Oil | .60 |
| Total | $ 11.80 |
| Adding fixed charges | $ 14.87 |

The 5-ton truck hauled 30 tons an average of 5 miles or 150 ton-miles per day, costing, therefore, 9.9 cents per ton-mile.

This shows an average saving on the basis of a year's work, of 4 cents per ton-mile or $6 a day or $1,350 a year.

The P. McGowan Contracting Co., of New York, operate two 7.5-ton Mack dump trucks on which they have kept records from which the following averages have been taken:

| | |
|---|---|
| Working days, number | 140 |
| Miles per day | 46 |
| Total mileage | 6,427 |
| Approximate No. of trips | 2,994 |
| Av. miles length of haul | 1.07 |
| Total fixed charges | $1,284.88 |
| Total operating cost | 1,453.94 |
| Total cost | $2,738.82 |
| Miles per gal. of gasoline | 3.25 |
| Miles per gal. of oil | 21.30 |
| Av. load, tons | 6. |
| Av. ton-miles, per day | 137.37 |
| Av. No. of loads per day | 21.4 |
| Av. cost per day | $ 19.56 |
| Av. cost per mile, cents | 43 |
| Av. cost per ton, cents | 15.50 |
| Av. cost per ton-mile, cents | 14.15 |

It is difficult in most cases to keep exact records of tonnage carried and mileage traveled in such way that the actual cost per ton-mile can be obtained, and there is, therefore, a tendency to assume the capacity of the truck as the

tonnage carried. This may be somewhere near correct on account of a tendency to overload trucks on occasion, but it is not accurate. Mr. Hutchinson's paper gives a number of other figures of cost which are not so definite nor so detailed as those given above, but which are of value for consideration of similar conditions. The constant demand for exact figures is being met more fully as the experience with trucks is greater, but the new uses for trucks are extending so fast that it will be some time before the figures of cost obtainable are so extensive as to answer all questions.

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## Trackless Trolley Lines in Austria

*By Frank C. Perkins*

THERE is a passenger and postal electric trackless trolley service running between the railway station and the town of Gmuend in Lower Austria, which is under municipal control. The trackless omnibus operates from 5 a. m. until 10 p. m., making from thirty to fifty trips per day, and this single car has carried about 45,000 passengers and over 1,000 packages, covering a distance of 15,959 kilometers (9,917 miles) without a single repair.

It is stated that, including the lighting of the car and the garage and operating the omnibus, the total consumption of current for the 16,000 kilometers (nearly 1,000 miles) travel was 3,030 kilowatt-hours. This is about 190 watt-hours per car per kilometer, 306 watt-hours per car mile, or 65 watts per kilometer-ton, 103 watts per ton-mile, on an average.

The trackless trolley line at Gmuend has gradients of 1 to 2 per cent., being slightly hilly the entire length, with a maximum grade of 4 per cent. for a distance of about 4 meters (13 feet). The cost of operation is exceedingly low on this line, all of the expenses, including current, for six months, being less than $600.00 per car. The cost of maintenance is said to have been $90.00 oil, grease $85.00, and current $190.00. The receipts of the line amounted to somewhat over 6,000 francs ($1,200.00) or double the cost of operation for that period.

### How It Works

The equipment and method of operation of the new Mercedes-Stoll electric trackless trolley traction equipment is seen in the accompanying photographs. The current is taken from the overhead positive wire and returned to the negative wire by means of flexible cables and not by a trolley pole, an over-running shoe being used instead of an under-running wheel. The current collector or head consists of a frame having two small, grooved wheels on each side of it, the positive wire supporting one of these pairs of wheels while the other pair runs on a negative wire, from which point there is also a weighted pendulum suspended for keeping the wheels down in contact with the trolley wires.

The trolley runs with little or no sparking, the wheels running on ball bearings and the pull of the cable acting upon a very short lever arm. The center of gravity of the trolley is very low, so that there is no deviation of the trolley, in spite of strong transversal pull, the conducting cable being lengthened so as to follow the car by two devices. There is an upper sliding knot tied up on the pendulum weight, as shown in the illustration, and stretched by means of a spring from the latter. There is also provided a cable roller with 30 or 40 feet of cable, which is let out or rolled up by means of a spiral spring.

VIENNA MUNICIPAL TRAMWAYS.
*Trackless trolley bus passing vehicle on the Potzleinsdorf-Salmannsdorf line.*

These two appliances allow the car to run on the whole width of the roadway, to turn out in overtaking or meeting automobiles or other vehicles and accommodate itself to every form of traffic. When two trackless trolley cars meet, the motormen simply interchange the trolley cables by detachable contact boxes, this being a decided advantage over a single track electric railway on which much time is lost in waiting at passing points.

In the chassis of the vehicles, pressed steel is used, weighing about 1,700 kilo-

grams (3,748 pounds). The brakes act on the back wheels and there are two motors provided, which form a part of the driving wheels themselves. The motors are of 20 horse-power each and are mounted on the driving wheels of the Lohner-Poreche system, so that there are no mechanical parts required for control or transmission with their accompanying losses.

Very little lubrication is required, as all parts of the motor and wheels run on ball-bearings. The cable transmits the current, which passed thru the axle and the armature of the motor is fixed on the axle itself by means of keys. The remainder of the wheel is mounted on ball-bearings as an ordinary motor and entirely enclosed and protected from dust, the cover hermetically sealing the motor as well as serving to fasten it on the axle.

### Cost of Operation

In Vienna, the cost of running the trackless cars 75 miles each daily is from 7 to 9 cents per mile, the line having a length of 2.2 kilometers (nearly 5 miles). The current cost for the 75 miles is from 40 to 60 cents, at 1 cent per kilowatt-hour. The tours with total load of 4.2 tons cost $1.50 to $2.00 wages, $1.50 for driver only, with taxes, repairs and garage, bringing the total running cost to from $5.20 to $6.30. The Vienna line passes thru narrow streets and around sharp corners and on grades of 10 per cent. for a long distance. The negative pole is connected to the Vienna city electric tracks and the positive pole of the trackless trolley to the city conduit conductors.

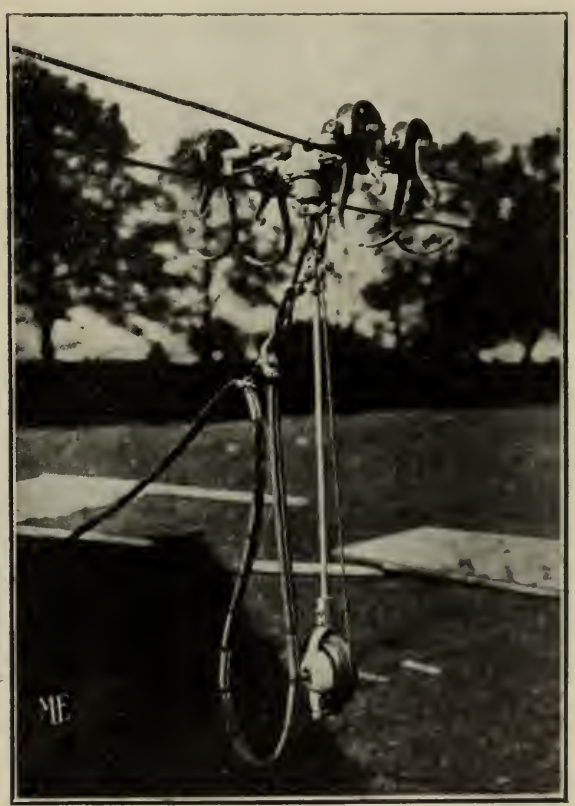
### Advantages Over Other Systems

This system possesses many advantages, both financial and mechanical, over electric storage battery cars, as well as gasoline or oil motor omnibuses. At Vienna the new Mercedes-Stoll trackless trolley is operated in connection with the municipal tramway and has just been started. The Pressburg line in Hungary has a total length of 5.8 kilometers (3.6 miles). It has four conductors, one freight wagon and six trackless trolley omnibuses. The total cost of the line is reported to be about one-third million crowns ($67,000).

The trackless trolley system, in operation at the places mentioned and others, is the invention of Herr Ludwig Stoll of Vienna. Among the strong claims made for the system are its simple, rapid, silent and smooth running, as well as its freedom from breakdowns and interruptions of service. Its great economy of operation and lightness of the omnibuses used are largely due to the motors, which form part of the road wheels of the cars.

At Weidling, not far from Vienna, the Stoll electric trackless trolley road is 2.3 miles long, having a steep gradient of 7 per cent. There are five trackless trolley cars or omnibuses in service, each carrying 21 passengers. About 100 miles are run daily from 5 o'clock in the morning until midnight. With three cars running, 2,700 passengers are carried without difficulty on Sundays. Non-stop runs are possible, only 10 seconds being required for interchanging the trolley cables at the meeting of the cars, this being done at any point on the line.

On these omnibuses solid tires are used and electric brakes, as well as mechanical brakes, are provided with pedal and hand control. The two 20-horse-power motors



CURRENT COLLECTOR *for Electric Trackless Trolley.*

on these trackless trolley omnibuses may be overloaded to double their output in emergencies without getting dangerously hot. The cars weigh 2.5 tons each and carry 22 passengers, this small weight compared with the load carried being of great importance in relation to road surface wear, rubber tire wear and consumption of current.

# CIVIC BEAUTY

## What Cedar Rapids Has Done in Five Years Under Commission Plan of Government

*By Hon. Louis Roth, Mayor.*

When the city of Cedar Rapids adopted the commission plan of city government, in 1908, there was constant friction between the east and the west sides of the city, which is bisected by the Cedar river. In the middle of the river and in the heart of the city was a low-lying island, some five acres in extent, upon which stood a few frame cottages and two or three business buildings. One section of a steel bridge connected this island with the west side and a similar section made the connection with the east side. A steel bridge at First avenue, just above the island, carried the street railway and general traffic. There was another old steel bridge at Sixteenth avenue, but a new concrete bridge had just been completed at Second avenue connecting the east and west sides of the city with the northerly point of the island. This bridge cost $84,000.00, exclusive of the pavement and sidewalks.

SIXTEENTH AVENUE BRIDGE, *Cedar Rapids, Iowa.*

The city at that time was doing its municipal business in an old ruin of a building which was built in the fifties for a hotel. The original building was of rubble and plaster, but frame additions had been made. The building was disreputable, but it stood on a good business corner at Third avenue and Second street.

One of the first acts of the first council under the commission plan of government was to send for Charles Mulford Robinson to prepare a plan for the harmonious development of the city along artistic lines. His chief recommendation was that the city acquire the island and establish there the civic center. The city council at once set itself to this task. The old city hall corner was sold for $63,000 and the island purchased for $125,000, the owners of the lots on the island taking mortgages for part of the payment. A big three-story brick building which has been used for a few years as a furniture store was remodeled for use as a temporary city hall at a cost of $20,000. A laundry building was remodeled for use as the police station and city jail at a cost of $6,500. A big barn to house all the city teams and machinery was constructed on the south end of the island between Fourth and Fifth avenues, at a cost of $8,000.

In the meantime, the city proceeded to fill the low-lying portions of the island and bring the whole to the general street grade. Cedar Rapids is a rapidly growing city and excavations are constantly being made for big office buildings in the business district close to the island. Contractors have been glad to use the island as a dumping place for the dirt excavated, at a very low cost to the city.

That portion of the island between Second and Third avenues has been brought to grade and now serves as a public park with trees, grass and flower-beds. Next year, that portion of the island between Third and Fourth avenues is to be similarly treated.

Below Fourth avenue, on the west shore of the island, a bathing beach has been established and a small bathhouse was built in 1912, at a cost of about $1,000, for the benefit of the boys and girls. This proved exceedingly popular and the commission is now planning for the erection of a much larger bathhouse this year.

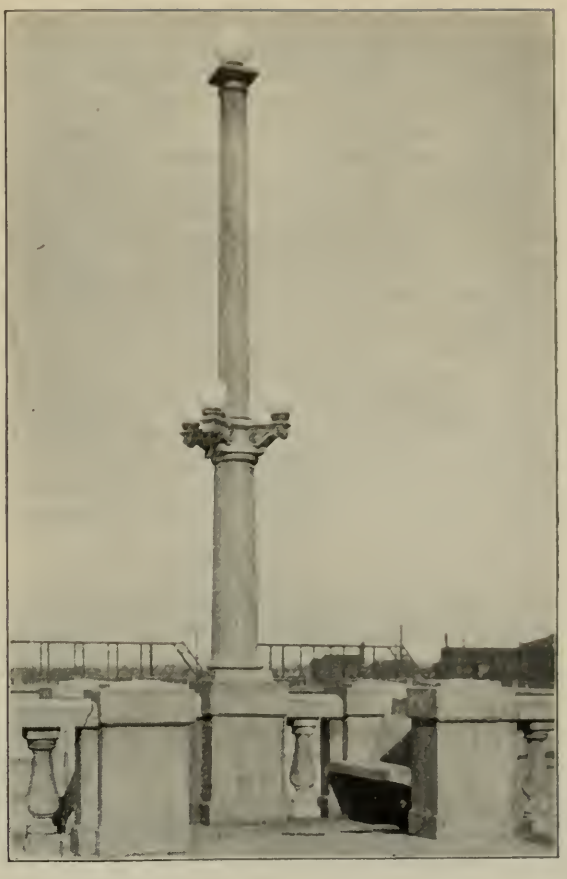
In 1911, the city council let a contract for the erection of a big concrete bridge at Third avenue and the removal of the old steel bridge to Eighth avenue. Both bridges are now practically completed, the steel bridge having been refitted and rebuilt at Eighth avenue at a cost of $25,000 while the total cost of the bridge at Third avenue, with the pavement, will be $160,000. This bridge has a total width of 68 feet, with two 10-foot sidewalks and a roadway of 48 feet. It was designed to carry the heaviest type of interurban cars and the probability is that a double street railway and interurban track will be laid across it this year.

While this bridge has been building, the city, with its own equipment and day labor has been building reinforced retaining walls and sidewalks along the banks of the island. These are completed from Second avenue to Third avenue and work is progressing on that portion of the island between Third and Fourth avenues, all the foundations having been put in during the last summer and fall. Next year this portion of the work will be completed, together with the filling and parking of this part of the island. It is here that the new city hall is to be built by and by, and the hope is that it will be a combined city and county building, one of the biggest and most ornate structures in the state.

Plans for the future also include the building of the island to a point above First avenue. A majestic soldiers' monument to be paid for by popular subscription will stand at the extreme head of the island. The present steel bridge at First avenue, which carries a double street railway track will be removed to make way for a concrete bridge similar to that just being completed at Third avenue.

Retaining walls are to be built along both sides of the river thru the business district and an 8-foot concrete dam is to be built at Sixteenth avenue so as to provide deep water suitable for boating in the summer and skating thru the winter thru the city from north to south.

The first city council under the commission plan, beginning in 1908, erected a handsome concrete bridge across the river at Sixteenth avenue, in the south end of the city. This bridge cost, complete, $75,000.00, and has been of immense value not only to business but also in uniting the two sides of the river into one.



A RETREAT *on Third Avenue Bridge, Cedar Rapids, Iowa.*

When the commission plan was adopted, the city had no permanent fire stations. Two handsome buildings of brick and cut stone have been erected at a cost of $7,000.00 each and another is now under construction, which will cost $10,000 when completed. This is to be provided with motor-driven fire fighting apparatus which will be this city's first venture in that direction.

Under the old form of government the three park commissioners had done splendid pioneer work in park development. This duty now falls upon one member of the commission, who is the superintendent of the Department of Parks and Public Property. The park development so well begun by the old park board has been well carried on by the park commissioner and the city now has 207 acres of parks properly landscaped and adequately furnished and cared for. The playground idea has been made prominent and much modern apparatus installed. Sunday afternoon band concerts are another popular feature.

Meantime, the city has been rapidly growing and the usual public improve-

ments have proceeded at a rate which was not possible under the old form of government. There have been large extensions in street paving. Every street and avenue throughout the city has its permanent sidewalks. Boulevard lights on handsome electroliers have been installed on the business streets. Storm water and sanitary sewers have been extended to the outskirts of the city. Miles of mains have been laid by the water commissioners, the city owning its own water plant. Large residential park additions have been landscaped by experts like Simonds, of Chicago. These additions have been paved, sewered, water mains, gas mains and electric light lines installed and ornamental trees and shrubs planted. Most of this has been made possible by the harmonious feeling that resulted from the establishment of the civic center on the island; and the fact that the commission plan of government, unlike the old ward system, studies and works for the development of the city as a whole. This year, the Cedar Rapids and Marion City Railway Company will spend $25,000 in the development of its property. The Iowa Railway and Light Company is building an electric line to Mt. Vernon, sixteen miles away.

All the improvements mentioned above have been secured without raising the tax levy. In fact, it is nearly two mills lower now than when the commission plan was adopted. The mortgages given on the island have been taken up, the bridge bonds are rapidly being retired and the credit of the city is gilt-edged. The record of the five years of commission plan of government in Cedar Rapids is one of continued progress towards definite ideals; a thoroughly modern, progressive, harmonious city.

The city owns its water works. The city took over the plant about eight years ago at an appraisement price of $473,000.00. Its net earnings since that time have been a little more than $190,000.00. The net earnings for each quarter average above $10,000.00, and the present valuation of the plant is $745,845.00. The plant is governed by three water works trustees under the direction of the city council. Their salaries are $300.00 per year, each.

We are now contemplating additional improvements; also the reduction of the minimum charge of water to 60c for the first 500 cubic feet. The whole venture has proven an unqualified success from the standpoint of the taxpayer as well as the city.

NATATORIUM *in open air for Chicago children. Fire department station in rear. Pumping station of water department on same property.*

## First Open Air Natatorium for Chicago

The first municipally owned "swimming hole' 'in Chicago is to be opened for Washington Heights and Tracy when the bathing season starts. It is an up-to-date natatorium, with diving paraphernalia, hot and cold shower baths, dressing-rooms and lockers. It has a capacity of 124,000 gallons, and will be filled with fresh water every day. The work, which is almost completed, has been done entirely by the city and paid for by an appropriation of $10,000 made by the council.

The swimming basin will be 50 by 90 feet, one of the largest in the city. It will have a fresh-air advantage over many others by being uninclosed, the swimmer being able to accumulate as much sunburn and tan as if he trudged the five miles to the lake.

For beginners, one edge of the basin will have only 3 feet of water, but a depth of 8 feet will be maintained at the other end. Four dressing-rooms, 160 lockers, bath towels, brushes and combs will make up the side line incidentals. An attendant will look after the property, and provide each swimmer with a two-piece suit to comply with the city ordinance.

The construction of the natatorium has been under the direction of Charles W. Kallal, city architect. Twenty-nine clusters of electric lights are to be installed, when it will be ready to turn over to the park commission.

### Presence of Firemen Means Safety

City property at One Hundred and Third street and Vincennes road, now partly used by the pumping station on one side and a fire engine-house on the other, was chosen as the site of the natatorium. The fire station is not more than fifteen feet from the water's edge, which makes the parents of the children feel safe about them.

"A municipal natatorium is the only thing," said Commissioner of Public Works McGann. "The city ought to have more of them, scattered in spots far from the lake. I believe every pumping station which the city constructs from this time forward should have a natatorium for the public as part of it. I have given orders that no plans for new pumping stations be drawn during my administration without a natatorium adjoined. When the city has the property and the water, and the people want it, give it to them."

The walls are entirely above ground, are waterproofed with McCormick Shamrock brand waterproof compound and show no signs of water seepage or leaks.

## East San Diego's Open Air City Hall

East San Diego is a thriving California municipality of the sixth class, incorporated November 2, 1912, with a population of 4,000, which is still growing at a rate faster than the 2,000 a year which that population represented.

Harvey M. Holleman is a young man with financial training in New York, sent to Texas to carry out some important

HARVEY HOLLEMAN, *Mayor of East San Diego, California.*

work for the Southern Pacific railroad, and passing thence to Denver, where he was a president, vice president of treasurer of several financial institutions, including bank, insurance, bond and loan companies. After three successful years there he moved to San Diego two years ago. He built a bungalow on City Heights, which was a little community of 200 population on the table land east of San Diego and 420 feet above the sea. His energy was evidently communicated to the place, for it has become the present city of East San Diego within that time. Very naturally Mr. Holleman is the first mayor of the new city, an honorary office, for no city officers draw salaries except the city attorney and the city clerk $300 a year, and the city treasurer $120 a year.

The new city has already street cars, telephones, water, electric lights, a $75,000 school house with adequate playgrounds, no saloons, and is occupying a unique city hall.

An observation tower was built some years ago to give views of the wonderful scenery in every direction and when the

OPEN AIR *City Hall, East San Diego, California.*

city grew the lot on which it was located was sold. To get rid of it the tower was sold at auction for 35 cents, sold again for $25, moved across the street and improved and now its five floors rent for $1,600 a year. The first three floors are business rooms, the fourth is fitted up for the city hall and the fifth is the city's council chamber. It is open to the air on all sides, as the photograph shows, and a special meeting of the board of trustees was held on Christmas day, 1912, with straw hats and shirt sleeves to demonstrate the beauties of the San Diego climate. The thermometer registered 71, nine degrees higher than at the beach, four miles away. The owner of the tower, C. O. Stensrud, has donated one year's rent of the council chamber to the city. The fifteen city officials hail from fourteen different states.

## Well Regulated Playgrounds

*By C. F. Booth, Supervisor of Playgrounds, Minneapolis, Minn.*

The importance of properly equipped and well regulated playgrounds cannot be overestimated. In Minneapolis we are making every effort to beautify and improve our playgrounds which are accomplishing splendid work with the children.

Trees are planted on the various grounds by the school children on Arbor Day in locations suggested by the superintendent of parks and the supervisor of playgrounds.

Waste barrels are provided by the city engineer's department, making it possible to keep the grounds much tidier, for every small boy and girl has candy and school papers or fruit skins, so these waste barrels fill a long-felt want.

Bubble drinking fountains are installed in all the shelter houses in addition to those provided on some of the grounds out of doors, and they are highly appreciated by the children.

The committee began during 1911 the collection of a library of playground information for its own use and that of the playground directors especially, but to be accessible to any interested in the subject. It is now housed in the chairman's office in a case provided out of funds donated by the original civic playground committee. It includes most of the publications to date of the National Recreation and Playground Association of America, files of the *Playground Magazine*, reports on playgrounds commissions in other cities, pamphlets on physical education and civic recreation work, and a few books on games, folk dancing, story telling and education by play. During July and August, many of our playgrounds are kept open several evenings a week. The play-directors remain on duty during these hours. The grounds are always cool and pleasant and are unusually well patronized. Shower baths, as well as apparatus, are always accessible.

The supervision of the play directing has been, as for several years past, in the hands of Prof. Carl F. Rothfuss, and the results have been most satisfactory. It becomes more clear as the work advances in St. Paul, that the direction and supervision of the play is one of the most important factors of the work. A young man and a young woman with special training have directed the activities on each ground.

It is the function of the playground and distinctly the duty of those who have charge to teach the children to play. Many children do not know how to play, and why is it? Is not play instinctive? And it is not children full of animal spirit who are the unmanageable ones, but more often those who do not care to play and would rather sit idly by, watching others. These are the children we have tried to reach in the past summer, and many examples of awakened interest have gladdened our hearts.

We find that the element of joy is strongly conducive to health and to make the children of our city happy is to assist in the great cause of civic reform.

The work has been along the same general lines as that of last year. The attendance was 225,000 for the year. Basket ball, centerball, baseball, field sports, swings, teeters, giant strides, slides, croquet, sandboxes, indoor games and the various minor attractions have maintained a steady hold upon the children.

Swings, teeters, sand-boxes, slides and merry-go-rounds are exceedingly popular with children, while gymnastic and athletic apparatus strikes the fancy of the older boys and girls.

Our gymnastic apparatus consists of:

8 horses.
8 bucks.
8 parallel bar sets.
16 gymnastic frames, containing rings, ladders, bars, sliding poles, etc.

Our athletic and game facilities consists of:

6 baseball back stops.
4 tennis back-stop frames.
9 jumping sets.
3 sets iron goals for foot ball.
15 sets basket ball goals and posts.
9 shot-put rings.

Our play apparatus consists of:

17 giant strides.
26 swing sets.
21 teeter sets.
30 sand boxes.
12 merry-go-rounds.

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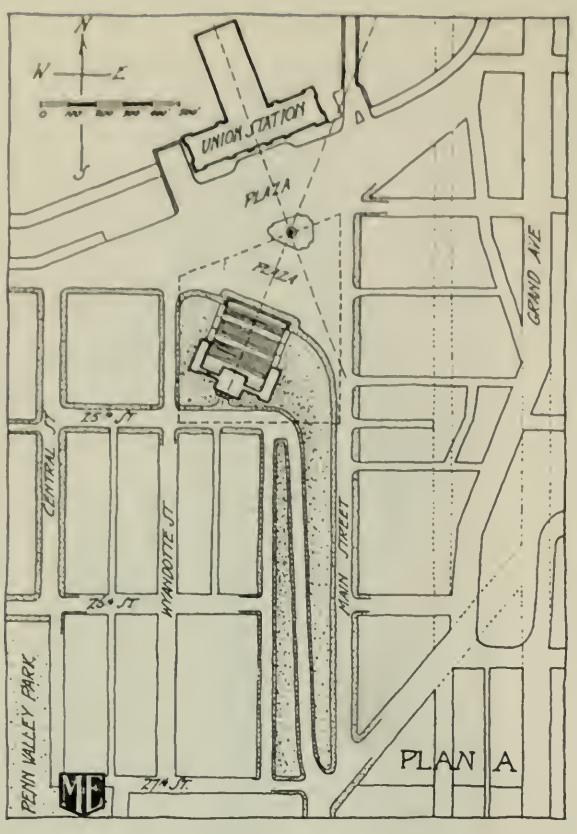
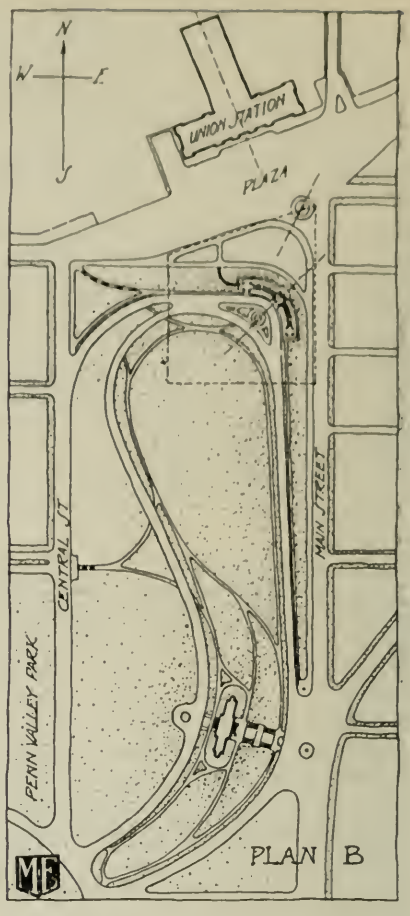
KANSAS CITY UNION STATION, *front on Plaza viewed from opposite direction from perspective view of Plan A. Under construction.*

## Beautifying Kansas City Union Station Surroundings

*By Ben J. Lubschez, A. I. A., Kansas City, Mo.*

The new Union Station which is nearing completion in Kansas City, has in front of it a plaza about 400 feet wide. Beyond this plaza is a bluff and high ground from 60 to 100 feet higher than the plaza. The Terminal Company building the station deeded 8½ acres of this




ground immediately facing the station to the city for park purposes. (See dotted lines on plans.) Main Street on the east of this property is being graded to meet the plaza level. This leaves the ground south of the plaza and west of Main Street high and inaccessible from the lower level. To grade all of this property would mean practically its confiscation, for the cost of grading would exceed the value of the property for many years. There is also the grave physical difficulty of there being no practical stopping place for the grading. The ground between Main Street and Grand Avenue on the east is also high, but on account of the great value of the property fronting on these streets, it is being gradually cut down by private owners.

The problem then resolves itself into terracing the bluffs at the edges of the high ground and adjusting the street grades to the Plaza and Main Street. This it is proposed to do in one of two ways: Plan A, proposed by the writer, and Plan B, proposed by the local park commission. As far as physical or rather topographical adjustments are concerned, the two plans are very similar, but Plan A is far more economical, taking only ¼ the frontage taken in Plan B, aside from the original 8½ acres deeded to the city.

Plan A differs mostly from Plan B in that it not only makes the high ground accessible from the plaza but leaves the greater part of it for use as hotel and apartment house sites, for which it is eminently suitable, and also in the treatment of the great terrace facing the station. This it is proposed to treat architecturally with monumental steps and crowning buildings. The plaza is enlarged and the ground lines and axes are balanced. In Plan B, all the high ground is taken for park purposes, there is no monumental architectural treatment proposed and altho the plaza is enlarged, no attempt is made to balance lines or axes. Tentative estimates show that Plan A, including architectural treatment, can be carried out in its entirety for less than the bare cost of acquiring the ground necessary for Plan B. It has been suggested that the crowning building in Plan A be a great art gallery, a suggestion for which is also made at the south end of Plan B.

Contracts are to be let immediately for the grading and terracing of the initial 8½ acres, shown by dotted lines on both plans.

# WATER AS AN ELEMENT IN CONCRETE CONSTRUCTION

*By H. A. Mark.*

The occasional failure of important concrete structures, when subjected to floods or other unexpected conditions, indicates that low cost and profits are given more consideration than strength and durability. Then, again, from the writer's observations of the work of others, he is led to believe that while a careful study has been made of cement, sand, and aggregate, the function, purpose, and effect of water in the mix is little understood.

Cement, sand, and the coarser aggregates are inert solids without cohesive or adhesive power. Water, on the other hand, is a fluid without adhesive or sticking power to join two substances together. But water has a very strong surface tension. This is exhibited in what is known as capillary attraction. It is water that binds the inert materials together. This binding power is greatest when every particle of cement, sand, and aggregate is covered with a continuous film of water. If too little water is present, or if it is not evenly distributed, the water film will be broken. If, on the other hand, the thickness of the film is increased to the filling of the interstices between the aggregate this binding power decreases until it is nothing when the solid particles of the mix become immersed in the water.

In addition to being a binder of the solid elements of the mix, the water acts as a lubricant, allowing the solid particles to slip on one another and assume positions resulting in smaller interstices. This increases the density of the mass, and also the capillary attraction of the water film, provided there is not sufficient water present to destroy this film tension. When the excess of water destroys film tension the solids become separated or "suspended" in the fluid. The finer particles of cement "float" in the water filling the interstices or settle from the mass on agitation, and at the same time the "lubrication" of the larger particles is not increased.

It is the finer particles of the cement that develop the greater strength, but when suspended in the fluid or separated from the mass, the "hands" of these particles are not sufficiently long to bridge the water gap separating them from one another or from the larger solids.

This film tension and lubrication can be easily illustrated by a couple of pieces of window or ground glass. Press together and separate by drawing apart at right angles to the plain of contact. Repeat the experiment with the glass dry, coated with a thin film of moisture, and immersed in water.

It is far easier to build up the water film by careful addition of water than it is to distribute the water after it has been added. If excess of water is added to one part of the mix, so as to "float" the fine particles of cement, it is a question if the film tension can be restored by mixing this with drier materials. This kind of concrete may appear all right, but one part of the mass will not be sufficiently lubricated so the solids can assume the positions for greatest density, and the other parts will be over wet so that the particles of solids will be separated by excess water, and film tension will be lacking in either case. When water is poured or flows from a pipe or nozzle, this is sure to be the effect. The less nearly the cement fills the interstices of the aggregate the more pronounced the effect will be from improper watering. When the water is in just the right proportion to furnish the lubricating effect and the greatest binding power, these forces tend of themselves to draw the particles together into the dense mass.

The third property of water in concrete is to furnish the element that causes crystallization of the cement, giving to the concrete its strength. The observation of the writer leads to the belief that the crystal takes the best form when the water is present as just described. But this will not give sufficient water for the complete growth of the crystal. More water must be fed it during the time of curing in order to grow it to maturity.

So far we have dealt with only the ideal or theoretical requirements. Among all the methods, manners, and systems of mixing concrete, there can be only one right, or ideal process for each particular combination of materials to develop its maximum strength and durability. But this may not be the most economical from the cost standpoint. A given aggregate with a given proportion of cement will, when properly handled in the watering and mixing, give a definite result. But it may be more economical to increase the cement content and do the work in a manner that will not develop the maximum strength. But until one knows the requirements of developing maximum strength, and the question of

water is one of the greatest of these, he runs great risks in attempting to sacrifice construction efficiency to profits and low cost of construction.

The writer has used much bank gravel in concrete construction. He has found it economy to screen the fine from the coarse aggregate. Mix the fine aggregate and the cement, and then mix this with the coarse aggregate, thoroly drenched. Following thoro mixing, water as needed, is added by sprinkling until tempered to the proper consistency. The sand, fine aggregate, should be just sufficiently damp to cause the cement to adhere. This dampens the cement and establishes capillary attraction. The coarse aggregate has but little capillary attraction and, on mixing, its excess of water is taken up by the superior attraction of the finer materials. In this way the material is all bound together.

If the water is added to the mix of cement and sand, making a mortar into which to mix the coarse material, a very poor bond is established between the two classes of materials. If all of the materials are mixed together before the addition of water, it is very hard to add the water without washing the cement from the larger particles or drowning the cement and fine sand. What has been said of sand and gravel is equally true of sand and broken stone.

With proper watering and curing the same strength is developed with one-half the cement as with improper watering. And when the work is properly managed the cost is very slightly increased. This is true of either hand or power mixing. It is simply a question of whether it is best to add brains or additional cement to the mix.

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## Technical Associations

The National Association of Cement Users will hold its next convention February 16-20, 1914, in connection with the Chicago Cement Show, which is scheduled for February 12-21.

The 1913 exhibit of the Brooklyn Engineers' Club was held at the club house the week of April 15. It included water works equipment, coal hoist, engineering instruments, construction materials, the ozonator and moving pictures of road construction, welding, sewage disposal, etc. This is a practical idea which might be adopted with benefit by other societies not already in line.

The classification of exhibits of the Panama-Pacific International Exposition at San Francisco in 1915 is the most comprehensive ever prepared. It consists of eleven departments divided into 136 groups and subdivided into 800 classes.

The fifty-fifth annual convention of the American Society of Civil Engineers will be held at Ottawa, Ont., Can., June 17-20.

*Le Mois Scientifique et Industriel*, 8 Rue Nouvelle, Paris, 9, which is one of the best of the monthly indexes of periodical and book literature on engineering subjects proposes to issue a cumulative index for the years 1906-1910, both inclusive, if it receives subscriptions enough at 6 or 8 francs, according to form chosen.

The Eastern Paving Brick Manufacturers' Association has been organized to aid in the work of the National Paving Brick Manufacturers' Association. It has absorbed the Pennsylvania association. The officers are: president, Charles E. Foster, of the Foster Paving Brick Co., Bradford, Pa.; first vice-president, J. B. Hammond, of the Bolivar Brick Co., Bolivar, Pa.; second vice-president, W. M. Hodges, of the Tuna Valley Pressed Brick Co., Bradford, Pa.; secretary, C. E. Young, with the Mack Manufacturing Co., with offices in the Arrott Building, Pittsburgh, Pa.; treasurer, C. P. Mayer, of the Mayer Brick Co., Bridgeville, Pa., who form the executive committee, together with Mr. Blair, of the Bessemer Limestone Co., Youngstown, O.; John Porter, of the Globe Brick Co., Wellsville, O.; John Hall, of the Westerman Brick Co., of Baltimore, Md.; Mr. McComb, with the American Sewer Pipe Co., Akron, O.; Joseph Nicholson, of the Toronto Fire Brick Co., Steubenville, O.; M. E. Gregory, of the Terra Cotta Brick & Tile Co., Corning, N. Y.; Warren DeRosay, of the Corry Brick & Tile Co., Corry, Pa. One important feature of this first meeting was the adoption of a uniform contract for the sale of paving brick and block.

The American Society of Engineering Contractors has issued an interesting booklet stating the purposes of the society which should interest all engineers and contractors.

The seventh annual meeting of the Playground and Recreation Association of America is held at Richmond, Va., May 6-10. A full program covering all parts of the field of this society has been arranged.

The fourth international congress on school hygiene will be held in Buffalo, N. Y., August 25-30. Dr. Thos. A. Storey, secretary general, College of the City of New York.

The January number of the Journal of the American Society of Engineering Contractors has a very comprehensive article by Geo. C. Warren on the "Development of the Modern Country Roadway," giving the practice in states with highway commissions with reference to macadam pavements, water and bitumen bound and going into some detail regarding the construction and maintenance of the better kinds of such road surfaces.

# PERSONAL

## A. Ormsby Graydon— A Reminiscence.

*By George C. Warren, Boston, Mass.*

Yours Very Faithfully
A Ormsby Graydon

To George C. Warren Esq
Boston. Mass

London Ont. 7 1905

Mr. Graydon was one of the best known and progressive municipal engineers. Born in the township of London, Ont., in 1852, he resided thruout his life in the city of London and was chief engineer of that city for twenty years.

The following is extracted from the Toronto Globe, March 1, 1913:

"Ex-City Engineer A. O. Graydon died at Victoria Hospital at noon today, February 28, 1913. He had been ill a few weeks and was reported as recovering, so that his sudden relapse this morning came as a great shock to his friends. Mr. Graydon was the son of the late Simpson H. Graydon, ex-mayor of London, and was born in this county in 1852. As a young man he entered the city engineering department, succeeding in 1891 to the post of city engineer, which he held for practically twenty years. Latterly he had been living in retirement at the family residence on Dundas street. His step-mother, five brothers and two sisters survive."

In connection with Mr. Graydon's life and illustrating his professional foresight, an interesting incident is indelibly stamped on the memory of the writer which seems to be worth repeating here in connection with his death.

In May, 1901, MUNICIPAL ENGINEERING published an article regarding some experimental work by the writer's brother, the late Fred J. Warren, outlining the principles of what has since developed into the Bitulithic pavement, then little more than a clearly defined thought in the inventor's mind following two years of laboratory research. The first of twenty-six succeeding patents had just been allowed and in the presence of a number of municipal engineers, an experimental area of the new pavement was laid in the driveway of the factory of

Warren Brothers Company at East Cambridge, Mass. Regarding the experiment MUNICIPAL ENGINEERING in the May, 1901, issue said in part:

"This seems to be the first piece of pavement laid on the principle of using stone of predetermined variation of size and completely filling the voids, the stone being larger than ¼ inch. The principle on which the work was based apparently received the approval of the practical road builders present and the outcome of the experiment will be watched with much interest. The attack of so interesting a problem as this in the manner described is worthy of attention, and whether the roadway is successful or not, the effort to reach the valuable truth in the theory is worthy of great commendation. Several of those present expressed their intention of laying some pavement on this plan during the year."

(Here an apparatus used in making screen and void tests was described.)

"Assuming that any even-sized grain yields from 40 to 50 per cent. of voids, a result can be obtained by measure in ten minutes after taking sample. For most accurate determinations weights must be taken, which will prolong the operation about an hour. A stone properly graded according to Mr. Warren's theory, will increase in volume about 30 per cent. when separated into the varying sizes by the screens, 1,000 cubic inches becoming about 1,300 cubic inches."

This briefly outlines the basic principles of the bitulithic pavement. In the twelve years of practical developments which have followed, the principle thus attained has not been changed, altho there have been constant improvements of detail in carrying out the principles. The city of Pawtucket, R. I., was the first municipality to adopt the then new pavement in practical street construction. A. Ormsby Graydon, the progressive city engineer of London, Ont., was the first to write to the inventor, immediately following the publication referred to above, expressing his approval of the principles outlined, and predicting that the invention would prove to be a practical success. Unfortunately about three years ago this letter with other mail was lost, but, as stated above, this early encouragement as well as subsequent endorsement is indelibly stamped on the writer's mind and he believes it is fitting to chronicle the incident at this time in connection with the passing of our friend from bodily presence with us.

For ten years the accompanying photograph with Mr. Graydon's autograph has hung in the writer's office and has been highly prized as a photograph of the writer of the first written professional endorsement of bitulithic pavement by a municipal engineer.

## Personal Notes

Walter T. Lemon is president of the Board of Public Works of St. Paul, Minn.

George H. Biles, of Harrisburg, Pa., has been appointed superintendent of maintenance of state highways for Pennsylvania.

H. F. McDonald and C. D. Brown have opened offices at 904 Confederation Life building, Winnipeg, Man., as consulting engineers and land surveyors.

Charles V. Seastone has been taken into partnership with Professor Daniel W. Mead of the University of Wisconsin in his consulting engineering practice at Madison, Wis.

Rodney Smith is city engineer of Auburn, Me., and F. I. Bisbee is superintendent of water works, by re-election.

J. A. Wilson has been appointed city engineer at Kamloop, B. C.

A. A. Kirkwood has been appointed city engineer of Forest Grove, Oregon.

W. N. Willis has been appointed city engineer of Spartanburg, S. C.

Hugh Gall has been appointed assistant county engineer of York county, Ontario.

W. Leroy Ulrich, of Manchester, Conn., has been appointed special assistant to the state highway commissioner of Connecticut.

John V. Fitzgerald is superintendent of streets of Revere, Mass.

R. E. Snowden, highway engineer of Snowden, N. C., has been appointed engineer in charge of construction and maintenance of roads of Craven county, N. C.

Dr. Homer M. Deer, professor of civil engineering at the South Dakota State College has been appointed state engineer of South Dakota.

E. A. Kingsley, 716 Southern Trust Bldg., Little Rock, Ark., has been appointed engineer in charge of street paving work of street improvement district No. 1 in Woodruff county. About 30 miles of road will be built at a cost of $100,000 during the coming summer.

James Nesbit Hazlehurst, of Atlanta, Ga., has been commissioned by the authorities of La Grange, Ga., to draw the plans and specifications for a gas plant, to be constructed and operated on municipal account, to be ready by June 1st. Mr. Hazlehurst will also arrange for the construction of a water plant, and will have supervision of the construction of both systems.

J. Frank Bowen has been appointed city engineer of Manchester, Vt.

Geo. W. Sparks has been reappointed a member of the Board of Street and Sewer Commission of Wilmington, Del.

E. C. Wilson and T. A. O'Donnell have been elected city engineer and street commissioner, respectively, of Waterville, Me.

Andrew J. McCrudden has been appointed borough engineer of Lansdowne, Pa.

J. A. Foster and E. A. McLaughlin have been elected chief engineer and road commissioner, respectively, of Winthrop, Mass.

W. D. Beers, of Salt Lake City, has been appointed state engineer of Utah.

George Sullivan has been appointed special supervising engineer for Lexington, Ky.

H. A. Brazier has been appointed assistant engineer for the city of London, Ont.

Arthur H. Blanchard, M. Am. Soc. C. E., professor of highway engineering, Columbia University, recently delivered addresses on "Modern Bituminous Pavements for Municipalities," before the Board of Trade of Elizabeth, N. J., and on "Highway Engineering in Europe and America," before the Brooklyn Institute of Arts and Sciences.

M. H. Baker has been appointed city engineer of Prince Albert, Sask.

J. K. McGrath has been appointed principal assistant to the chief paving engineer of Baltimore.

Albert Wolstenholme has been appointed superintendent of streets and surveyor of highways for Fall River, Mass.

B. B. Weber has been elected city engineer of Oil City, Pa.

W. H. Beeman, of Montreal, P. Q., has been appointed Civic Commissioner of Sherbrooke, P. Q., in charge of road work.

Charles M. Talbert has been appointed street commissioner of St. Louis, Mo.

Clifford Richardson has moved his offices to 1615 Woolworth building, 233 Broadway, New York City.

J. Leopold & Co. have moved their offices to the Woolworth building, 233 Broadway, New York City.

Edward O'Brien has been appointed street commissioner of Medina, N. Y.

N. R. Harmon has been appointed county road engineer of Marion county, Ky.

Charles A. Roamer has been reappointed county superintendent of highways of Rensselaer county, New York.

John E. Field has been appointed state engineer of Colorado.

E. R. Morgan has been appointed state road engineer of Utah.

H. P. Parsons has been appointed city engineer of Petersborough, Ont., at a salary of $2,500.

Z. E. Sevison has been appointed city engineer of Laramie, Wyo. He is also county engineer of Albany county.

Curtis Hill has been appointed provisional city engineer of Kansas City, Mo.

Mellis B. Ferguson has been appointed city engineer of St. Thomas. Ont., at a salary of $2,000 per year.

Mr. Holland has been appointed city engineer of Guelph, Ont.

Sylvester Q. Cannon has been appointed city engineer of Salt Lake City, Utah.

C. W. Marx is now associated with J. A. Stewart, C. E., in the practice of civil engineering at 1112 Traction building, Cincinnati, O., paying attention to steel and reinforced concrete, difficult foundations, steam heating, ventilation, factory engineering, sewerage, pavements and surveys.

## Technical Associations

The International Civic Bureau, 1 Madison avenue, New York, under an advisory board and a committee of arrangements selected from officials in various national civic organizations and a large number of European authorities as well as the local officials of cities to be visited, has arranged four tours of Europe for the observation and study of civic, social, industrial and asthetic problems in various cities in Germany, Austria, Belgium, Holland, France and England. Itineraries of the tours covering July, August and September, 1913, are ready for distribution.

The Mayor's Society of New Jersey, is in its second year and has about fifty members. Frederick W. Donnelly, mayor of Trenton, is president and Frank J. Murray, mayor of Orange, is secretary and treasurer. The society is working upon the appointment of an expert in municipal work as permanent secretary who will be an efficient aid to the members officially and individually.

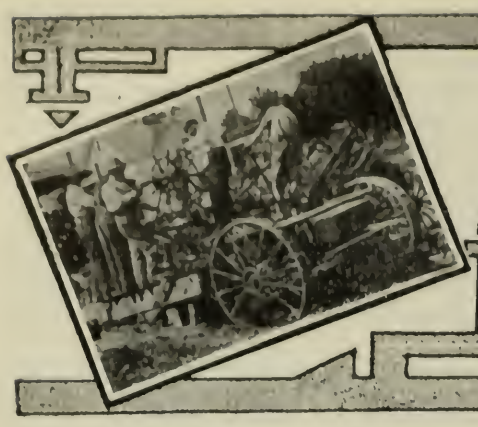
The National Old Trails Road Association held its second convention at Kansas City, Mo., April 29, 30. The program was full of push for the coast to coast highway on this line.

Ernest F. Jonson presented at the April meeting of the Municipal Engineers of the city of New York an illustrated paper on methods of inspection of materials of construction used in connection with the Catskill aqueduct.

## Technical Schools

The engineering experiment station of the Iowa State College of Agriculture and Mechanic Arts, at Ames, has published Bulletin 26 on "The Production of Excessive Hydrogen Sulfid in Sewage Disposal Plants and Consequent Disintegration of the Concrete," by W. M. Barr and R. E. Buchanan, which gives the reason for observed deterioration of concrete about such plants.

Illinois Central locomotive No. 958, loaned to the University of Illinois for testing purposes, is the first to be tested in the new testing plant. It was received April 11.



# MACHINERY AND SUPPLIES

## Thomas Reinforced Concrete Pavement in Detroit

*By N. H. Beasley.*

The use of concrete in road construction work has received great advancement thru the Thomas system of steel reinforcing for pavements, which has been attracting more than ordinary attention in and around Detroit during the past two or three years and this spring the Detroit board of public works has provided, in its estimates, for the paving of a number of streets in the western part of the city with concrete.

The Thomas system was put to an exhaustive test on Parkview avenue, which leads from Jefferson avenue to the public

REINFORCED CONCRETE PAVEMENT *in Detroit, on a first-class residence street.*

lighting station. There is extremely heavy traffic over it and in previous seasons it was necessary for the board annually to make improvements in the cedar block pavements or relay them entirely. The Thomas system was tried out and has given entire satisfaction.

Six points were considered when the Thomas system was originated: Comparative durability of different kinds of paving material. The best way in which to lay pavement to obtain the best results. The actual wear. The best method for cushioning pavements. The safe limit of load and speed. The best mixture for concrete roads.

The type of pavement invented by A. O. Thomas, a practical civil engineer, is practically noiseless, even less noisy than sheet asphalt, and from the nature of its combination is free from dust. Its surface has a moderate degree of roughness, thus preventing skidding of automobiles and the danger of falling by animals. In Detroit this feature of roughness is practically necessary. There are more motor cars on the streets of Detroit than in any city in the country and there is always a demand from the motorists for a pavement that will eliminate this danger as much as possible.

The Thomas pavement is one, also, that appeals to the taxpayer. It can be laid at a price as low as, if not lower than, cedar block and many types of asphalt macadam. It will outwear cedar block; it is low in first cost, requires little repairs for a number of years and has the attractive qualities of the high-priced pavements.

One great difficulty that was overcome by Mr. Thomas in his system was the danger of cracking. Plain concrete has a tendency to shrink during the hardening process and it is also susceptible to expansion and contraction under changes in temperature. The tendency to crack has been overcome in this system by the proper distribution of steel thruout the mass, thus taking care of all the stresses developed. The actual laying of pavement during freezing weather has demonstrated the practicability of the plan. In case of repairs for the laying of sewers, gas pipes or water pipes, the repairs can be made as cheaply as with any other pavement. Resurfacing can be done very cheaply and in a permanent manner without affecting the foundation, which remains undisturbed, securing a smooth appearance.

### Method of Laying

Generally the two top bars are placed 2 feet center to center and those at the bottom 4 feet center to center, but this may vary according to latitude and climatic conditions. The vertical supports or stools are made of light angle iron sheared at the bottom so as to bend the

METHOD OF SETTING UP *reinforcement for Thomas pavement.*

feet which give a bearing on the grade surface of the road. Two sets of parallel horizontal bars are placed transversely and longitudinally and firmly attached to the vertical supports by a simple device which clinches the bars when engaged in the support. The support is the most important member in the system. It takes hold of the bars and fixes them between its wings. If expansion joints are used every 30 feet and the street is 24 feet wide, the location of these supports, which are generally placed 4 feet on centers, makes a large stone 24 feet wide by 30 feet long, composed of small stones 4 feet by 4 feet, without any joint between the small stones. The method used in constructing an expansion joint prevents any crack in the concrete between the reinforcing bars and the plate of the expansion joint. In other words the structure must act as a unit. The top bars of steel are heavier because they are nearer the top of the pavement and subject to greater differences in temperature. The bottom bar is heavy enough to take care of any strains that would be caused by an irregular motion of the mass of concrete due to the friction between the uneven surface of the subgrade and the concrete slab, particularly under the influences of arched sections or the formation of ice under the pavement if water gathers there in freezing weather to produce an upward pressure. The reinforcement besides taking care of the shrinkage causes the concrete to act as a beam and prevents any cracks or depressions when heavy loads pass over the surface.

George Jerome, surveyor, civil and municipal engineer, in Detroit, had this to say of the system:

"I believe the Thomas system of reinforced pavements is one of the best ever devised and I am recommending it in every paving proposition that comes before me. I have just finished my second season in the use of the system and it certainly has given satisfaction. The first street I laid was in November, 1910, and after exceedingly cold winters and hot summers there is not a crack visible. Since that street was laid I have put down three miles more and at first there was considerable opposition to the pavement because of the general impression that concrete cracked too easily. There have been no complaints of this nature regarding the Thomas system. The City of Detroit paved Elmwood avenue, a street about one mile in length, the following summer and the Thomas system was not used. The concrete now shows numerous cracks. At first I was opposed to concrete but I have been won over to the Thomas system by the results attained by placing your material and it has met my most sanguine expectations."

## Sewer Pipe in Large Sizes

*By L. G. Blackmer, Blackmer & Post Pipe Co., St. Louis, Mo.*

The continued demand for our large sizes of vitrified pipe, 27, 28, 30, 33, 36, 39 and 42-inch, for sanitary and storm sewers, and for railroad culverts, gravity water mains and other uses, has fully justified the additional buildings, kilns, machinery and equipment for their economical production and handling that we completed in 1910. In fact, the demand for these sizes is now exceeding the capacity then provided, and we are arranging to make further additions, which will increase our output. These additions, when completed, will give us a capacity greater than that of any other exclusively vitrified clay products plant in the United States.

The popularity of our 27 to 36-inch pipe encouraged us to think that even larger sizes would meet with equal favor, and we have been assured by many prominent engineers that they favor the use of vitrified pipe in the largest diameters it can be made, and that they would give it preference over any other material for sewers. These declarations made

us decide to undertake the manufacture of 42-inch pipe.

With the knowledge which comes from experience we have been enabled to steadily decrease the cost of manufacturing by reducing the percentage of loss in burning, and at the same time improve the quality of the finished material. There is now no doubt that when the cost of transportation is not excessive, our large sizes of vitrified pipe can be laid in the ground as cheaply as the corresponding sizes of brick sewer.

Sanitary engineers generally freely concede that a hard burned vitrified pipe with smoothly glazed inner surface, properly laid, and the joint carefully made with gasket and cement, has 20 to 25 per cent. greater capacity than any other sewer of the same size, which, however carefully constructed, cannot be made as smooth as a salt-glazed vitrified pipe. The difference in capacity is due to the decrease in frictional resistance.

A much wider trench is required in which to construct a brick or concrete sewer, which adds materially to the cost of excavation and back-filling, for it is obvious that when the brick sewer requires walls of 8 inches, not only does this entail additional excavation over and above that required by the thickness of the material for the pipe sewer, but there must be room enough left at the spring line between the sheathing and the finished arch for the bricklayers to properly do their work.

The substitution of a 30-inch vitrified pipe for a 32-inch brick sewer would give about 15 per cent. greater capacity and save nearly 40 per cent. in the width of the ditch, the 30-inch pipe requiring only 42 inches in width and the 32-inch brick sewer, with two rings of brick, taking up 56 inches in width. This not only means a saving in excavation, but in the generally crowded condition of city streets, with water and gas pipes, and wire conduits underneath and car tracks on the surface of the same, the saving of 14 or more inches in width might permit of sewer construction without the moving of any other underground work or car tracks, thereby keeping the streets open to traffic instead of blocking them off, as is so commonly done.

It is a fact of some importance that the pipe sewer may be constructed more rapidly, two able-bodied expert pipe layers being able to lay the pipes and cement the joints about as fast as the pipes can be lowered into the ditch by a derrick.

The Board of Health of London, England, after a thorough investigation of the comparative merits of brick sewers and vitrified pipe, in their general report say:

"The general use of large brick sewers has resulted from ignorance or neglect. Such sewers are wasteful in construction and repair, and costly through inefficient efforts to keep them free from deposits. Brick or stone house drains are false in principle, and wasteful in the cleansing, construction and repair. House drains and sewers properly constructed of vitrified pipe retain and accumulate no deposit, emit no offensive smells, and require no additional supplies of water to keep them clean."

Never having determined by actual and intelligent test the external pressure our large sizes of vitrified pipe would stand without breaking, and believing that reliable information regarding same would be desirable in making comparison of the merits of brick sewers and pipe sewers, we selected from the stock in our yard this material, which was sent to the works of the Geo. J. Fritz Foundry and Machine Co., 2038 South Third street, St. Louis, where each section of vitrified pipe was tested, with results as shown:

| | Lbs. |
|---|---|
| 1 section 24-inch double strength vitrified pipe, 2 inches thick, broke at | 27,610 |
| 1 section broke at | 28,715 |
| 1 section 27-inch double strength vitrified pipe, 2¼ inches thick, broke at | 33,133 |
| 1 section broke at | 32,763 |
| 1 section 30-inch double strength vitrified pipe, 2½ inches thick, broke at | 27,987 |
| 1 section broke at | 24,297 |
| 1 section 27-inch standard vitrified pipe, 2⅛ inches thick, broke at | 23,986 |
| 1 section broke at | 22,530 |
| 1 section 30-inch standard vitrified pipe, 2¼ inches thick, broke at | 27,875 |

(Signed) H. R. GATES,

Supt. Geo. Fritz Foundry and Machine Co., 2038 South Third St., St. Louis, Mo.

## Resurfacing Old Pavements

*By W. K. Cooper, Sec., Union Asphalt Construction Co., Indianapolis, Ind.*

On the subject of repaving and repairing old pavements by means of the Lutz surface heater, we beg to submit the following:

We have one of these heaters, and we think well of it. We have not had, as yet, the opportunity in Indianapolis to use it in resurfacing a large yardage of old pavements. Some two years ago we selected, as an experiment, and with the approval of our city civil engineer, the south half of intersection of Meridian and South streets to use in resurfacing the old brick pavement in this intersection, with the Lutz surface heater. This

is an intersection where much heavy hauling exists. It is located between the wholesale district and freight depots. This will indicate to you, in a measure, the extent of the heavy traffic to which the intersection is subjected. To look at the intersection today you would never know that an old worn-out brick pavement was underneath the asphalt surface, and the asphalt top is in as good condition now as it was when laid two years ago. We have had city officials from Terre Haute and other neighboring cities to inspect it and all have been pleased with it.

In our judgment it will be no mistake to introduce this heater into cities having worn out brick or asphalt pavements, and use the same, in resurfacing, to the end that you will have a new modern pavement where before was a street unsatisfactory to all traffic. We have done very little street patching with the heater for the reason that we have had very little work of this character to do up to the present time.

Irrespective of the construction, any pavement will need repairs in time, whether from wear and tear, expansion and contraction, or improper repairing of excavation. What is done in the repairing of old pavements should be done in such a manner as to be most efficient, economical, and without any sign of where the patch or repairing was done. There is no gainsaying the fact that it is better to resurface the majority of our old worn out brick, cobble-stone and asphalt pavements than to tear them up and relay entirely new pavements.

Cutting out and plugging in methods of repairing asphalt pavements leave unsightly signs of the repairs made. It takes time to do a lot of the details necessary in thus repairing such a pavement and very often it has been shown that in such cases the joint between the patch and the old pavement has not been sealed, due either to what is known as a dirty joint or to carelessness on the part of the laborer in not painting over part of the exposed edge of the depression.

This condition is easily observed when, after a rain, the sun has dried up the surface of the pavement, while the patches are definitely outlined by a wet line. Another source of trouble comes from the pushing or displacement of patches because of the material used. The patching material should be as nearly as possible of the same consistency as the old pavement, so that when the summer's sun warms up the pavement, the old and the new material may soften to the same degree. The folly of using a new street mix as patching material in an old pavement has frequently been examplified.

A temperature variation of from 5 to 10 degrees below zero to 120 or 130 degrees in the summer's sun, on the surface of the pavement, presents a complex problem concerning the proper mixture to be used. Under slow-moving, heavy loads in the summer, the material is apt to push or creep, bringing about a wavy or undulating condition of the surface. Such a pavement is very "bumpy" to the automobilist. This condition can frequently be remedied by the use of Lutz surface heaters. By this means, the bumps or high places are softened and all the burned and soft material is scraped off, leaving a clean surface of the old material. Such burning should be continued until the burned area will require at least 1 inch of added material to restore the pavement to its proper surface and cross-section. In almost every case, it is well to cut a joint at the edge of the burned area, 1 inch or 1½ inches deep, so that the edge of the old pavement may serve as a shoulder for the new material.

The importance of asphalt maintenance manifests itself more and more to the city officials and tax payers as the maintenance under the original contract expires. It then becomes the duty of the officials to maintain these streets in the most economical way. The old way of chopping out is expensive and not satisfactory for these reasons: The new, hot material does not weld or vulcanize onto the old, cold pavement, even though painted with hot liquid asphalt. There being no union between the old and new material, cracks open up, admitting destructive elements, causing decomposition to set in. The result of such methods is a garment of many patches soon necessitating replacement.

The Lutz method consists in drawing a large volume of air, heated to the proper temperature, from a heating chamber and blowing it with great force upon the asphalt or other bituminous pavement thereby gently heating and softening without flame the old pavement to the same consistency as the new material. Then with the use of hoe and rake all disintegrated materials, uneven or worn surfaces are removed and joints cut, and while the pavement is still hot sufficient new material to bring up the grade and contour of the street is added. The temperature of both materials being at the vulcanizing point, when tamped, smoothed and rolled a perfect weld is produced, leaving a finished surface. Instead of having a patch, the repair becomes a part of the whole.

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## One-Piece Gutter Inlet

The Municipal inlet was designed to meet the conditions where the existing catch basins are in a position other than

on the line of the curbs of a proposed street improvement. The catch basins are sometimes located and built at fixed distances from the center lines of the streets when the sewer system is installed, and consequently will be in the line of the curb for one width of roadway only. This means that it will be found generally necessary to convey the street drainage from the gutter to the existing catch basins by means of an inlet and sewer pipe connection. The old method of providing for an opening thru the curb and connecting thence to the catch basin brought the pipe connection within a few inches of the surface of the parkway, which can readily be seen was poor construction.

The Municipal inlet is a one-piece iron casting set in the curb and gutter, and on account of the goose neck design, makes its junction with the sewer pipe connection to the catch basin well below the parkway. On account of its hooded height above the surface of the gutter, it is almost impossible for the inlet to become clogged, and it is easily rodded or flushed.

Where the street improvement provides for curb and gutter, the inlet is set in accurate position and the concrete merely tamped around it, allowing of the uninterrupted construction of the curb and gutter. This feature will appeal both to the engineer and contractor. The appearance of the street being important, it will be noted that this inlet when in place presents a pleasing and inconspicuous effect. This patented inlet is made by the Municipal Inlet Co., Chicago.

## Drinking Fountains in Menasha

*By Ira H. Clough.*

The city of Menasha, Wis., maintains several municipal watering fountains, popularly known as "bubblers," which are purchased from the Gier & Dail Mfg. Co., of Lansing, Mich. Four of these fountains were purchased by the city of Menasha little more than eight months ago, after a heated debate among the members of the common council. Today no stauncher admirers of this sanitary form of public drinking fountain can be found than the city officials who were most determined in denouncing the plan for the proposed purchase of the fountains. One of the drinking fountains is located in the city park and three others are distributed promiscuously about the various portions of the business district of the city.

A report of the city park commission shows that more than five hundred adults and children visited the drinking fountain at the city park on a single day of last summer. The accompanying photo-

GIER & DAIL FOUNTAIN *installed at Menasha, Wis.*

graph shows one of the drinking fountains in winter attire, stripped of the drinking cups and water pipes, but ornamental in appearance despite this handicap. The continual flow of water during the seasons of spring, summer and fall renders the Gier & Dail drinking fountain a leader from the point of sanitation.

All of the water passing into the fountain passes thru the drinking cups, a feature heartily indorsed by state health inspectors. The fountain is 7 feet in height, and an ornamental dome, electrically lighted, makes the fountain an object of beauty both day and night. During the big home-coming celebration, when Menasha entertained more than fifty thousand out-of-town guests, the drinking fountains were offered and accepted as an important evidence of the city's advancement. Merchants have contributed liberally toward the cost of lighting the fountains and have offered a personal guarantee to provide for the repair of the fountains in case they should show the effects of wear or weather. The purchase of several additional fountains, to be stationed in the residence districts of the city, is being contemplated by the city council at the present time.

## The Directograph Pitometer

The Municipal Supply Company, Western Union Bldg., Chicago, have quite recently invented and placed on the market the Directograph Pitometer, an instrument for recording rates of flow in pipes, etc., measured by Pitot tubes, Venturi tubes or other devices in the use of which the result desired is obtained by the measurement of the difference between two pressures. The instrument has been designed for use in connection with a Pitot tube for measuring the rate of flow in a water main. The Pitot tube is of an improved form, having two orifices or pressure openings and connected with pressure tubes passing through a metal casing of such form and length as will permit its insertion into a water main through a one-inch opening and allow it to be set at any point along the diameter of the pipe. These two pressure tubes are connected by means of rubber or metal tubes to a glass "U" tube containing a liquid slightly heavier than water, thus forming a good serviceable indicating flow meter for use in cases where a short test measurement is desired on any pipe line.

When it is desired to obtain a continuous record of the rate of flow, from which the total of any line, as, for example, a pumping station discharge, is to be computed, the recording device is connected in parallel with the "U" tube. This arrangement allows the instrument to be used either for indicating or recording the rate of flow and furnishes an absolutely reliable means for checking the adjustment of the recorder.

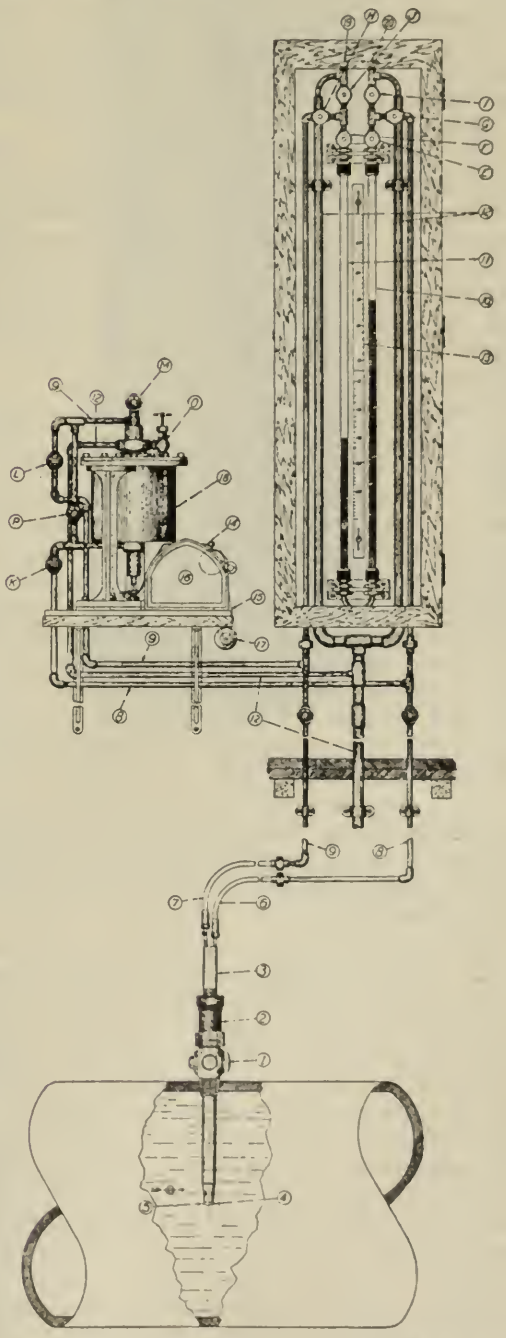
The recorder consists of a collapsible metal box or bellows, containing a heli-

*By Wm. A. Braden, Treas., The Braden*

cal spring made of phosphor bronze, enclosed in a cylindrical brass case in such a manner as to form two separate pressure chambers. The upper chamber or inside of the collapsible box is connected to the up-stream or impact orifice of the Pitot tube, and the lower or outer is connected to the down stream or trailing orifice. If there is no flow in the main line the collapsible box will stand at a normal position of rest, as the pressure in both chambers will be equal, but if the water in the main is in motion the pressure on the upper chamber is greater than in the lower chamber and the bellows is extended a distance which is dependent upon the amount of difference between the pressure of the two chambers, and the resistance of the helical spring. This thrust, transformed by means of rollers and cam into a rotary position, is transmitted thru a frictionless packing gland to a pen arm, and thence to the paper chart.

A one-inch cylindrical opening is made in the water main, usually by means of a one-inch corporation cock, as shown at (1). To this cock is attached a "new type" stuffing box (2) which is so arranged that the "new type" pitometer rod (3) can be removed to any position along the diameter of the pipe and rotated so that the axis of the orifices (4) and (5) can be made parallel to the axis of the pipe.

These orifices are set at various known points across the pipe, and the ratio of the mean velocity at this cross section of the pipe to the velocity at the center, or some other known point is determined. This operation is termed "traversing," the result being the "pipe coefficient."



THE DIRECTOGRAPH PITOMETER.

With a flow in the direction shown by the arrow, orifice (5), the impact orifice, receives a greater pressure than the "trailing" orifice (4). These pressures are transmitted thru separate openings in the rod, thru the flexible tubes (6) and (7), and thru the pressure pipes (8) and (9) and to the glass tubes (10) and (11) to the new type of indicating differential gage and also to the low and high pressure connections (8) and (9) of the Directograph recording differential gage.

The differential pressures are indicated in the "U" tube by the rise and fall (termed deflection) of a dark red colored liquid, having a specific gravity greater than water, and are read on an adjustable double scale (13) which can be graduated to read in terms of feet velocity per second; gallons per minute; gallons per 24 hours; pump revolutions or otherwise (so that no other calculations of any kind are required).

The directions for filling the glass tubes with the red fluid are as follows:

Close valves (G) and (H) on the pressure pipes (8) and (9), then open the valves (E), (F), (I) and (J), unscrew and remove either plug (19) or (20), insert funnel and pour in slowly the red liquid until it fills both glass tubes to zero on the adjustable scale.

After the tubes are filled as above with the liquid, close valves (E) and (F), then open valves (G) and (H), allowing water from the main to flow freely out thru the overflow pipes (12). The object of this operation is to allow any air which may be in the pressure pipes or flexible metallic tubes to escape. Such air will readily escape since the pressure pipes are installed on a rising grade and the overflow or blow-off valves (I) and (J) are at the highest point in the system. By operating the valves (I) and (J) in conjunction with the valves (E) and (F) the air can also be blown out of the glass tubes, thus freeing the entire "U" tube of air, which is the essentially important feature to the correct operation of the instrument.

Valves (K) and (L) control respectively the low and high pressure of the "Directograph Recorder" (18). Valves (M) and (O) are blow-off valves which allows the air to be freed from the high and low pressure chambers of the recorder. Valve (P) being the by-pass or equalizing valve should be open to partially balance the pressures in the two chambers, before valves (M) and (O) are opened. Valves (M) and (O) should be manipulated as to keep the pen (14) within range of the paper chart (15) thus avoiding excessive pressures on the sensitive diaphragms which separate the high and low pressure chambers and transfer the differences of the pressure to the actuating mechanism of the pen arm.

The paper recording chart is in the form of a continuous ribbon about four inches wide and is drawn at the rate of one inch per hour by friction rolls which in turn are driven by means of a power clock (16), thus giving an unbroken direct graphic record of the rate of flow from hour to hour thru the pipe. It will be noted that this recording chart is visible at all times, which is very important. Every variation in the rate of flow in the pipe, together with the time and extent of such variations is permanently recorded on the chart, which is always visible.

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## Washing San Francisco Streets

*By Peter J. Owen, Supt. of Street Cleaning Dept., Board of Public Works, San Francisco, Cal.*

We have been operating a number of Squeegee machines on our smooth surfaced, as well as brick, pavements with great success. We are cleaning about 30,000 square yards per day with minimum water consumption.

The sprinkling attachments do not operate under pressure and consequently the water is not placed upon the pavements with sufficient force to wash out or break up the brick filler or otherwise pound or injure the pavement. The water is applied to the surface in gentle fashion and as it raises no splashing or dust the machine can be operated in the day time on our most heavily congested streets. The machine is noiseless in its operation and as the scrubbing work done by the squeegee is minus all throwing of dirt and slime no discomfort is caused to vehicles. The revolving rubber squeegee takes up every drop of water and uses same in thoroughly scrubbing the pavement. These machines remove every particle of oil and grease and leave the pavement in a thoroghly sanitary condition.

We are using this type of machine very extensively in view of the fact that it does the work of a sprinkler and flusher in one operation. It consumes about one-third of the water required by ordinary sprinklers and flushers.

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## Guide Post for Municipalities

*By William A. Braden, Treas. The Braden System Company, Chicago.*

We need a better way of guiding the traffic in the downtown section of our cities, where we should pass each other in an orderly and systematic manner at the street crossings.

We should remove some of the danger

of passing automobiles on the boulevards where the street cars or steam railway trains cross, by automatically giving the cars or trains the right of way and flashing the danger signal on the boulevard traffic in time to avoid serious accidents.

We should have the names of streets placed in conspicuous position on the corners at the intersections.

We all should know where north, south, east and west actually are.

We should know what the names of the nearby streets are when we are strange in a section of a city.

We should know where to find a fire alarm box anywhere in the city at a moment's notice, without asking questions, and we should have the box located where it is the most noticeable object in sight when we are mailing letters; thus acquainting all where the fire alarm box is.

We should have all the public phones and the various apparatus, more particularly the mail and package boxes housed in a neat receptacle that will enhance the general appearance of all neighborhoods.

We want these guide posts illuminated at night by electric lights in such a manner that the street illumination has a more artistic effect, and is more useful, by giving us a street name that we can see at night as well as by day.

We should know at a glance the hour of the next mail collection without consulting a book of rules or asking questions.

The Braden System Guide Post and Utility Column is a useful ornament, 12 feet high and 30 inches square.

The traffic controller is incorporated at the very top of the guide post, above the street name sign, while just below is a guide which shows the various directions, north, south, east and west.

About 4 feet lower a local street guide shows the names of the next six streets in each direction with street numbers at intersections, also the various railroad stations and various roads entering same.

Immediately below this street and railway guide are located the various public phones and the fire alarm box.

Just below the letter box opening is an automatic indicator that gives minute and hour of the next mail collection.

The package box is just below the letter box, both of which are constructed in such manner that the mail collector can more readily remove the contents. He can observe the interior at night as well as in the day time, because the boxes are both illuminated so that he can see what he is doing. The light from the external illumination of the column is transferred through perforations.

THE BRADEN *Municipal Guide Post.*

The letter box opening and the next collection indicator are illuminated at night for the convenience of those who have occasion to mail letters after dark.

The fire alarm box is placed in the Braden system guide posts immediately above the letter drop to automatically educate the populace that the fire alarm box is where they mail their letters and is therefore available in emergency for action without hesitation or question. Many more guide posts than fire boxes will be placed, therefore, the posts have transparent red glass sections on all four sides just above the local street guide, which are of themselves ample notification in the day time and many times more noticeable at night. On the inside of the red sections is an electric lamp

which is illuminated the instant the fire alarm door is opened, to notify the local patrolman.

There is a space also in the guide post for the police department phone which under some systems has a vibrating electric ball or buzzer to call the police officer, which is just as likely to disturb a miscreant doing a little job.

The illumination below the fire and police boxes is to help out the general effect. The local street guide is illuminated at night.

The traffic controller is useful in congested districts to the traffic squad by placing one guide post at each corner of the crossing, four in all, controlled from one predetermined column and electrically connected to work in unison and pairs in such manner, for example, that the traffic going east and west has the right of way over that going north and south, or vice versa, as desired by the operator.

Where street railway cars cross a boulevard two posts or columns are arranged at the right hand sides of the boulevard traffic; the semaphore or traffic controller in this case gives the traffic the right of way, except when a street car approaches the danger zone and is about to cross, when the stop signal is displayed automatically and does not require an operator unless there is excessive traffic on the street on which the car runs.

The usefulness of our guide posts is almost unlimited. A case in point is, for instance, San Francisco, Cal., where they are preparing to entertain the whole of the earth, they will want those people to know where and how they can get the worth of their money day and night. The guide post in districts where announcements are desired will tell the people where to go and how to get there during the early daylight hours, say till 3 or 4 p. m. at which time all the announcements in this particular district may be changed to special doings for the evening or succeeding day merely by throwing an electric switch.

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## Clean Sewers

"No longer can a municipality afford to overlook the conditions of its sewers," states Frank Gillelen, of the firm of Overbach & Gillelen, sanitary engineers. Los Angeles, Cal. "The water carrying method, by means of closed pipes is undoubtedly most efficient if their pipes are kept properly cleaned so as not to become clogged.

"Usually germs of disease find their way from one patient to another thru excreta. Hence the necessity for extreme care in the disposal of excretions of all kinds. Sewage becomes, then, the possible source of disease and must not be neglected. It is costly to dispose of it properly, but the cost is more than counterbalanced by the easily calculable money value of life and health to many people.

"Sewers should be kept in an unclogged condition at all times. Tree roots, hair pins, sand and grease will create a stoppage and frightful epidemics often result.

"A machine which will clean sewers of every impediment should be owned by every city or village operating pipe lines for carrying sewage to point of purification or disposal.

"Our attention has been called to the Turbine machine, which is made in Milwaukee, and which has been used with great success in such cities as Sacramento, Cal.; Tulsa, Okla.; Memphis, Tenn.; St. Louis, Mo.; Salt Lake City, Utah; Kansas City, Kans., etc.

"The machine itself consists of a central brass barrel about 25 inches long, with arms carrying four guides, and at the forward end is a miniature hydraulic turbine with three revolving scraper blades. For ordinary work, a rope or cable is passed from one manhole to another by means of quick-coupling sewer rods, the far end of the cable being then attached to a swivel clevis or shackle at the front end of the cleaner. A fire hose, attached to a hydrant, is coupled to the rear of the barrel. Another cable is also connected to the rear of the machine, and this is secured to the hose at intervals, by chain clamps in order to relieve the strain on the hose. Each cable passes over a guide pulley at the bottom of the manhole, and has its upper end wound upon the drum of a compound-geared winch or hand windlass, which is erected over each manhole.

The apparatus being thus connected, the cleaner is entered into the sewer at the upper manhole and the water turned on, while the windlass at the next manhole is operated so as to pull the cleaner through the sewer. With a water pressure of 60 pounds, the turbine is said to develop about 3 horse power. The revolving blades cut and churn all obstructions and with the strong jets of water the material is churned into a grout which flows away in front of the machine to the lower manhole. The machine can be hauled back with the rear cable for a second trip if necessary.

When a sewer is so choked that the pulling cable cannot be passed through by the sewer rods, the cleaner is pushed instead of pulled along the sewer. For this purpose the head rod is attached to the rear end of the cleaner, and a special

ROOTS *of Poplar Trees Removed from Sewer, Salt Lake City, Utah, by Turbine Sewer Renovating Machine.*

worm-gear forcing jack is placed at the bottom of the manhole. This manhole would be at the lower end of the sewer grade. The hose is attached to the barrel as before, and the machine is allowed to work a few minutes to cut and soften the material before being forced ahead.

## Efficiency in Fire Apparatus

*By E. A. Wilkinson, Gen. Mgr., Nott Fire Engine Co., Minneapolis, Minn.*

In the opinion of the writer, the present is not the right time for the manufacturers to comment on the maintenance of motor fire apparatus as against the maintenance of horse-drawn apparatus and if I were to comment on the efficiency of motor fire apparatus I might be misunderstood by some of the readers.

Motor fire engines, which are supplanting the old time-tried steam fire engines, require a good deal of study. The average fire chief today does not go into the matter deep enough because it is too new to him. The average chief has been in the habit when he wanted a steam fire engine for his departemnt of asking his purchasing department to buy a certain size steam fire engine. He knew when he did this that when he bought from any one of the three fire engine apparatus builders he was going to get a good fire engine, but I regret to say that this does not hold with the manufacturers of gasoline fire engines.

We are going through the same experiences today in regard to motor fire apparatus that these companies went through thirty or forty years ago when they adopted the steam fire engine to take the place of the hand pump. In those days nearly every blacksmith shop and machine shop started to build a steam fire engine with the result that after a good deal of experimenting it got down to a specialty of building steam fire engines for the purpose.

We spent four years of the hardest work of our lives designing and perfecting a gasoline pumping engine that would not have to apologize to the efficiency of the steam fire engine, which has been perfected in forty years' work of the best mechanical talent of this country and by large expenditure of money.

Heretofore, it has been the practice of some companies to put engines on the market purely to sell, with absolutely no regard for the future, and if continued it will eventually bring about lost confidence among the fire chiefs in motor fire engines. On the other hand there is not a modern steam fire engine on the market but after three years of service will improve in its efficiency as the newness of the engine is worn out and it becomes free and easy to handle.

This company has given the motor fire apparatus very thorough consideration, and we are looking ahead to the time when every successful manufacturer will have to design his motor fire apparatus for fire department use exclusively, just as was done in the building of the old time-tried steam fire engine.

There is no reason why a gasoline pumping engine should not last from ten to fifteen years and maintain at least 90 to 95 per cent. of its original efficiency, if designed and made for fire department use and properly taken care of by the fire department, when a steam fire engine will last from twenty to thirty years and maintain its efficiency when properly cared for.

## The Concrete Sidewalk

*By Richard L. Dale, Contractor, Mt. Carroll, Ill.*

It is no longer a question of building the concrete sidewalk well enough to keep the pedestrian out of the mud, but of putting down a sidewalk which will last, one which will be a credit to the community on account of its general appearance. Up to the present time, no material has been discovered which can compare in durability, appearance and economy to the sidewalk built of concrete.

In spite of steadily advancing wages and raw materials costs, the municipality is securing better concrete paving, sidewalks and bridges than ever and for less money than was paid ten years ago. Wages and materials show an increase of 35 per cent. during the past ten years. The successful bidder is he who bids lowest and in order to counterbalance increased costs of materials and labor, he has been compelled to take every possible advantage of improved mixing machinery.

We operate the Standard Low Charging Mixers as manufactured by the Standard Scale and Supply Co., in our general concrete construction work as we believe these machines most easily adapt themselves to the many different classes of work in this section. This machine averages one batch per minute and has low charging features which possess many advantages in foundation, bridge, pavement and sidewalk construction. It does not require any elevating loading devices and the consequent saving in mixer is considerable, to say nothing of labor saving effected. These machines are equally suitable for either a dry or wet mix with any material. Our experience has been that more evenly tempered cement mortar can be mixed in the "Standard" than by the hand method and at considerably less cost.

We are keeping an accurate record of different jobs and will supply you with photos and tabulated costs for your subsequent issues.

The semi-automatic discharge feature of our mixer will undoubtedly be of interest to contractors as it is not necessary to employ a special man to operate the discharge door. The barrow-wheeler throws the lever himself. The door is held in either mixing or discharging position by a strong spring under tension and it is only necessary for the operator to throw this door past the center of tension in either direction and the spring will complete the movement and hold the door until it is again thrown by the operator. This door can be thrown open for discharging and left open until the entire batch is discharged or, on the mixers made to discharge about three cubic feet or one wheelbarrow load of concrete per revolution, the door can be closed after a barrow of concrete is discharged and allowed to remain closed until the succeeding barrowman has placed another barrow in receiving position, when the operation is repeated.

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## Waterproofing Huntington Water Tower

*By F. William Stocker, Inc., Waterproofing Engineers and Contractors, New York City.*

Following is a brief description of the work performed in connection with waterproofing of water tower at Huntington, L. I.

The water tank is a reinforced concrete structure supported on twelve reinforced concrete columns 40 feet high. The tank is 18 feet high inside, 18 feet wide at the bottom and 26 feet long. The walls are 3 feet thick at the bottom and 1 foot 6 inches at the top. The tank is divided by a 12-inch wall dividing the tower in two sections. This wall has a hole at the bottom so that the water is at the same level in both sections at all times.

The bottom rests on reinforced concrete arches joining the columns and is 2 feet 3 inches thick.

A circular tower adjoins the tank and was cast integral with it.

The following copy of a report prepared by our engineer describes in detail the condition of the tank after its completion.

### Engineer's Report on Construction

"I visited the works on the 28th of June, 1912, accompanied by Mr. Stocker, of the Ceresit Waterproofing Company, and beg to report as follows:

"I find that the exterior of the tank walls shows numerous pockets of loose stones barely sticking together by a thin coat of cement and sand. The stones can, however, be easily loosened by a light tapping or even the pressure of the fingers. I personally penetrated the wall to a depth of about 12 inches by tapping the stones with a light ¾-inch bolt. The spot is located below the outside shelf intended to carry the insulating material. Even at that depth there was evidence of honeycomb. This condition is typical of a good many spots on the outside.

The interior of the tank is practically in the same condition. Certain parts have been covered with mortar in an attempt to remedy the defects. This mortar, however, is cracked in few instances due to the richness of the mortar that was used in patching. Large holes have

been dug out showing that the honeycomb is not only on the surface but well into the wall. In the case of the division wall between the two sections of the tank, holes were dug out right through the wall. The reinforcing bars which can be seen where the loose concrete has been removed are not properly surrounded with mortar, a condition which, unless remedied, will impair the strength of the tank. Even behind the smooth part of the wall evidence of honeycomb can be found, indicated by a hollow sound when tapped and also by the fact that a wire could be pushed some distance in small holes in the surface coat of mortar.

### Deductions

"The general condition of the concrete indicates that the mixture of cement and sand was of such proportion as to form a good mortar but the amount of mortar was not sufficient to completely surround the stones and make a dense concrete such as would be required for a piece of concrete work intended to hold water.

"It is also evident that the amount of water used in the mixing of the concrete was insufficient as shown by the steep angle of the various strata of concrete and the failure of the concrete to properly surround the reinforcing bars. Owing to the large quantity of steel in these walls, it would have been policy to mix the concrete very wet in order that it might have flowed properly around the bars and in every part of the forms and made a dense wall.

### Conclusion

"In view of the above observations, I conclude that the reason of this defective piece of work does not lie with the materials used but in the way they were handled, mainly the improper proportioning of the sand and stone, the use of too little water in the mix and the depositing of too large a quantity of concrete at one place at a time, which could not be spread in the wall and puddled thus allowing the concrete to arch over the reinforcement and form pockets.

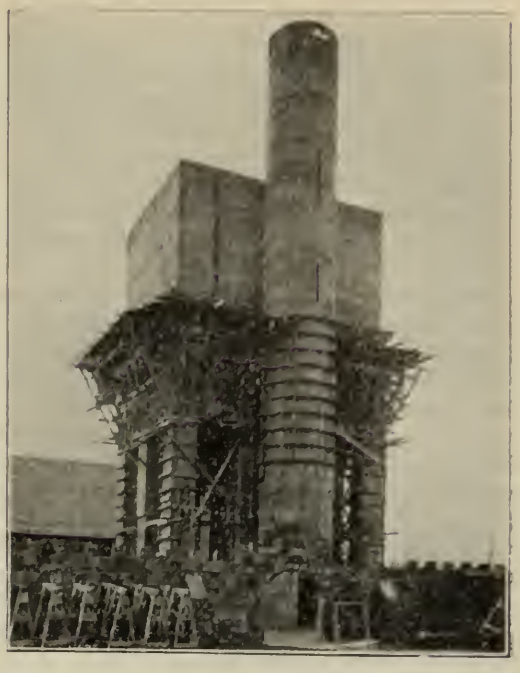
"It will be necessary to remove a thin face mortar off the entire inside of the tank to determine the exact condition of the wall and arrive at a proper solution as to what should be done to make the structure safe and tight."

The tank is supplied by a 6-inch pipe and when water was first pumped into the tank, the water level could not be raised more than 4 inches above the bottom.

### Condition Remedied by Waterproofing

The method adopted in waterproofing the structure was as follows:

The entire interior of the tank was



HUNTINGTON, L. I. *Water Tower.*

picked with hammers to remove the thin coat of cement which faced the wall and expose the concrete. This surface was then thoroughly washed and brushed to remove all loose material. The holes referred to in the report were dug out and all loose stones removed; the larger holes were concreted, wooden forms being used, and the smaller holes grouted with Ceresitized mortar. The entire surface was then lined with ½-inch rods spaced about 18 inches on centers which were wired to the wall reinforcement, the concrete having been removed in sections sufficiently to expose the reinforcing rods. Four-inch expanded metal was then wired to these rods. The walls were then saturated with water and a 1 to 2 omrtar tempered with a 1 to 12 solution of Ceresit was applied to the walls, the mortar being thrown on the wall with a trowel in small quantities. Great care was taken to fill the spaces between the expanded metal and the wall.

The floor was covered with heavier expanded metal and a 4-inch concrete floor put on top of it. The concrete was mixed in the proportion of 1 part cement, 2 parts sand and 3 parts of ½-inch stone, tempered with Ceresit water.

The expanded metal on the floor and wall was lapped and wired together and the concrete floor was carried up the side walls to form a solid cove around the bottom about 8 inches high.

This floor was trowelled down to a hard surface.

After the first coat of mortar on the walls had set sufficiently, the walls were washed down with a thin grout and a second coat of mortar was applied.

This work was performed in the summer time, and on account of the excessive heat the exterior of the tower was kept wet to reduce the temperature inside of the tank. The cement walls were kept moist to give the concrete the best setting condition.

The second coat was scratched and followed by a third coat which was trowelled to a hard surface.

Between the second and third coats, the tank was filled with water and showed a few leaks on the outside which were traced to a pocket in the soffit of the opening in the center wall. The water penetrated inside of the wall at that point and worked itself through the porous concrete to the outside and dripped in few places; this defect was remedied and the third coat applied. The interior of the tank was kept moist for a period of ten days and a week later the tank was refilled; no sign of water could be seen anywhere.

The total thickness of coating does not exceed 1½ inches and is effectively holding a hydrostatic pressure of 8 lbs. per square inch.

Subsequent examinations of the tank made monthly have so far failed to reveal the slightest leak.

## Cleaning Vancouver Streets

*By P. Wylie, Supt. of Street Maintenance, Vancouver, B. C.*

The equipment of our street cleaning department consists of:

1 Runabout auto for inspection purposes,
56 Horses,
30 Carts.
3 Dump wagons,
2 Pick-up brooms,
5 Single horse brooms,
1 Combination grader,
5 Single horse scrapers,
3 Revolving hand brooms,
3 Pressure flushers,
1 Gasoline pressure flusher,
34 Receiving boxes,
96 Hand carts,
4 Horse brooms,
2 Steel slop carts,
1 Hose truck,
700 feet rubber hose,
2 Sprinklers (2 horse),
200 Waste paper receptacles.

The maintaining of streets in Vancouver in a clean condition is a very hard matter owing to the prevailing conditions, more especially in the business section. There are three existing conditions in this department which cause endless trouble, and to which I would call your especial attention, viz:

The present practice of allowing contractors to carry the earth and mud from the cellars and excavations in the central part of the city. Littering the streets with mud and slush should be prohibited. The practice of allowing contractors to pass over the sidewalks of main thoroughfares where good alleys exist in the rear should be stopped. I would not permit any contractor to come out on a main thoroughfare without a permit from the city engineer, and I feel sure if the city by-law were amended to this extent, the streets would be in a much better shape when the class of work referred to is being carried on.

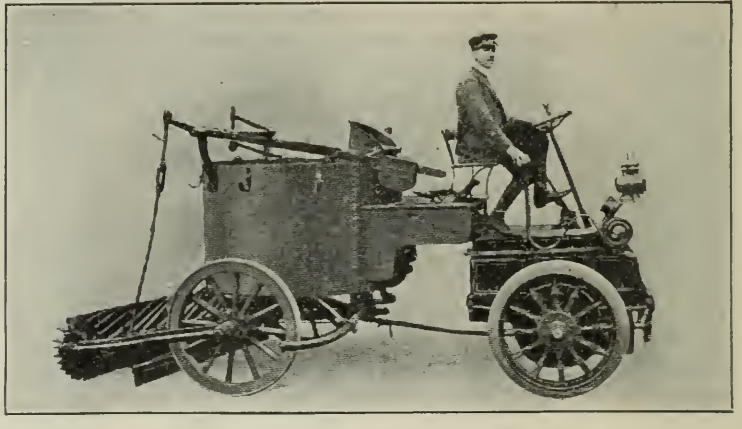
The road oilers and flushers which we operate are made by E. D. Etnyre & Co., Oregon, Illinois.

## Elmendorf on Berlin

Milwaukee makes the squeegee street cleaning machines that Berlin uses and to which it owes in part its reputation for being the cleanest city in the world, according to Dwight L. Elmendorf, in his illustrated lecture on Berlin.

"Berlin's streets are literally scrubbed," he said. "You can sit in the shining thoroughfares and not soil your clothing. Between midnight and 6 a. m. great squads of squeegee machines invade the streets and cleaning is done without interfering with traffic."

Mr. Elmendorf contrasted this thorough cleaning process with the usual American method of raking up the dust in little piles, which are scattered by the wind, collected again laboriously and spread ad infinitum.



ELECTRIC SQUEEGEE, *machine used for washing streets in Paris and Berlin.*

In control of the street car companies, Berlin does things, said Mr. Elmendorf, which would be met with the old American howl that it can't be done, things so radical that public service companies

here would have us put in the insane asylum if suggested to them.

The street car owners, private corporations, are compelled to plant trees along the elevated lines to hide them from public view. Surface roads also must plant flowers and beautify the street at the direction of the city officials, wherever it is possible. The surface cars are small, noiseless and run frequently. Certain cars permit an exact number of standing passengers for a reduced fare. There is no crowding of cars, said Mr. Elmendorf.

The illustration herewith represents an electric-driven squeegee machine as used in Berlin and Paris and described in the lectures of Dwight L. Elmendorf. The machine is made for this country by the Kindling Machinery Co., Milwaukee, Wis.

## The Light Motor Truck

That public utility companies and various municipalities are gradually replacing their light horse-drawn trucks by light motor trucks is demonstrated by the increasing number of trucks seen on the streets of any city, large or small.

The advantages of motor trucks over horse-drawn vehicles have been demonstrated so thoroly that it will not be long until public utility companies will find it absolutely necessary to use these vehicles. Modern business methods demand quick transportation. Hence the motor truck assists the corporation in the matter of developing its business facility for delivering. The motor truck can be applied to any kind of business. The small, light motor truck is especially adapted for different municipal departments. A great deal of the work on the state highways is being done by motor trucks, the contractors finding that they can haul material for the construction work to all sections of the road with greater speed, and at less cost than can be done by horse-drawn vehicles.

Performance proves that the motor truck is not subject to the elements, extreme heat or cold, and this is one of the big reasons for its growing popularity. The Peoples Gas, Light & Coke Co., and The Chicago Telephone Co. operate several serverciable Mercury trucks of 1,000 pounds capacity and at a great saving over an equal number of horse-drawn wagons. The average load carried on a 2,000-pound truck does not exceed 600 pounds, except in cases where large single pieces are hauled. At a less initial cost, two 1,000-pound trucks can be had and will do the work at all times; one of them most of the time, because it is lighter and faster, while the other is there for emergency.

If but one 2,000-pound truck is used, and that is out of order, the work is not done. With two 1,000-pound trucks the load may always be carried without question. One can be operated at about half the expense of a one-ton truck, including the driver. Of course, this would not apply in all cases, but when the load does not consist of single pieces weighing from 1,000 to 2,000 pounds, it does apply and the statements above are absolutely correct in every particular. The saving in tires, gasoline, oil and time is wonderful.

## Rockford Playgrounds Popular

*By Paul B. Reis, Supt. Board of Park Commissioners, Rockford, Ill.*

We are giving especial attention to the development of playground features thruout our park system. It is our intention to have more playground festivals and outdoor performances of the character of those held in Chicago playgrounds to be given by the children of the public schools during the coming summer.

The park board hopes to acquire other tracts of land for playground purposes in parts of the city which are not yet served with park privileges. The members of the board have in mind several tracts,

GALVANIZED SWINGS *are used in Rockford playgrounds, made by Fred Medart Mfg. Co., St. Louis, Mo.*

some of which will be undoubtedly acquired during the coming season.

The park board decided that Rockford parks ought to be places where all the children of the city might go and play and have the benefit of the beautiful shade trees, the grass and the flowers. A place much safer, cleaner and better in every way than the railroad yard, the alleys and the streets. The parks are now the big yards for all the children to play in. Many poor children have to be taught to play. The simple, healthy, wholesome games they know nothing about; the seesaw, "London Bridge is Falling Down," or "Ring Around the Rosy."

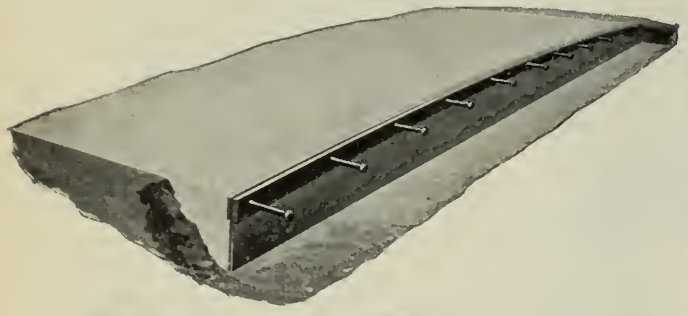
With all this in mind the park board has changed four of the large parks into public play grounds. There are swings, see-saws, rings, trapezes, sand piles and wading pools for the children. There are baseball diamonds for large and small, tennis courts, and cricket grounds, and in one park as fine a third of a mile cinder track as can be found in the state.

At present, we have installed combination athletic frames, consisting of flying trapeze, flying rings, horizontal bars, sliding poles and shutes. We also have a set of swings for girls and boys and small children, teeters and teeter ladders, flying Dutchmen, giant strides, small chutes for children, and merry-go rounds. We find the most popular pieces in use are the merry-go rounds for the small children, and the teeters and swings for the larger folks. We also have parallel bars and vaulting horses and find the athletic frames much used by the young men. Tennis and base ball, of course, are very popular, and it is very hard to furnish enough courts and diamonds to accommodate all players; but we are fortunate in being able to supply enough for the present time. and are in position to add to these in the future. Our outdoor basket ball court has taken tremendously well.

## Trus-Con Armor Plate

We are illustrating herewith two armor plates in blades with ¼-inch asphaltum felt filler as made by the Trussed Concrete Mixer Co., Detroit, Michigan.

The installation of this type of armor plate is accomplished by clamping the two bars together with a layer of asphaltum felt of desired thickness between, the felt cutting the entire depth of the pavement. Or of preferred, a steel plate is placed temporarily between the two armor plates and is removed after concrete is poured, the space then being filled with plastic asphaltum. Either process is satisfactory, will allow of expansion and will prevent joint filling with grit; although felt method is somewhat cheaper. The assembled plates are held in place at exact grade line by being attached temporarily to side grade boards and supported by pins driven into subgrade.



TWO TRUS-CON ARMOR PLATES *in place, protecting the joint with ¼-inch asphaltum felt for filler, cutting entire depth of pavement.*

This steel plate is said to protect and insure even gradual wear of the so-called weakest part of the concrete pavement. It is said to be thick enough, deep enough and hard enough to protect the edge against which it is placed for a period of the entire life of the pavement.

## Fuel Saving and Smoke Prevention Thru the Use of a Smokeless Firebox Boiler

*By Robert W. Hunt & Company, Engineers, Chicago.*

The question of smoke prevention is one being largely discussed at the present time. Many of our American cities have awakened to the fact that smoke is absolutely harmful to the health of their inhabitants in addition to rendering almost impossible the beautification of a city, not to speak of the extra tax imposed on the citizens through the increase in cost of clean linen, clean homes, all so necessary to good health and civic pride.

Quite naturally the first "smokeless" agitation raised a storm of protest from the owners of smoking stacks. It was argued that were a smoke ordinance enacted it would compel the use of anthracite or Pocahontas coal (both expensive), or the installation of costly smoke prevention devices.

However, experience has shown that the commercial smokeless boiler of today (and there are several good makes on the market), is not only fully sufficient in smoke-prevention ability to meet the most stringent smoke ordinance; but also is so much more economical in the use of coal, and permits the use of much cheaper coal, that the coal saving effected by such a boiler quickly repays the cost of the installation and actually earns profit for the owner through the coal saving it effects.

That the above statements are true is proven by tests made by us, both regular and smokeless firebox boilers being used. These tests were made at Kewanee, Illinois, using a Kewanee firebox boiler No. 12 (designated Boiler No. 2 in following tests), and a Kewanee smokeless firebox boiler No. 11 (designated as No. 1 in following tests).

The efficiency of these boilers, as shown by these tests, shows a remarkable saving when the smokeless type of boiler is used. Note that with boiler No. 1 (the

Kewanee smokeless boiler), the efficiency ranges from 47.1 per cent to 74.9 per cent. as against efficiency of 39.5 per cent. to 65.2 per cent. shown by boiler No. 2.

Comparing the different tests in which different coal was used, shows the following:

The figures relative to the density of the smoke emitted from the stack during these tests are also most interesting.

By average density is meant the percentage of time that black smoke would need be emitted to equal the smoke actually observed. According to these tests it

With Iowa slack.....Smokeless 47.1 per cent., Regular 39.5 per cent. efficiency
Iowa slack .....Smokeless 57.9 per cent., Regular 43.3 per cent. efficiency
Illinois mine run .....Smokeless 59.3 per cent., Regular 48.5 per cent. efficiency
Illinois nut .....Smokeless 67.0 per cent., Regular 56.1 per cent. efficiency
Illinois lump .....Smokeless 74.3 per cent., Regular 65.2 per cent. efficiency
Pocahontas .....Smokeless 74.9 per cent., Regular 57.2 per cent. efficiency

Commercially speaking, a boiler of 75 per cent. efficiency, that is a boiler that will utilize 75 per cent. of the heat units in the coal, is perfect.

And as the efficiency of the majority of boilers ranges from 51.70 per cent with Illinois lump coal to 57.42 per cent. with Pocahontas (as shown by tests made at the University of Illinois Engineering Experiment Station, their bulletin (No. 51), the value of the use of a smokeless boiler is conclusively demonstrated.

can very safely be stated that the boilers used are well within the requirements of the strictest smoke ordinance yet passed or likely to be passed.

We present these figures as an aid to anyone who is giving consideration to the smoke nuisance.

And our experience shows us first, that smokeless boilers can be and are being manufactured; and second, that the use of such a type of boiler means decreased coal bills.

---

Boiler Number 1. (No. 11 Kewanee Smokeless Boiler.)

| Test number | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Duration of trial, hrs... | 10.00 | 10.10 | 9.37 | 11.95 | 10.10 | 9.31 |
| Pressures— | | | | | | |
| Barometric, inches ..... | 29.450 | 29.250 | 28.81 | 28.98 | 29.070 | 29.290 |
| Steam (cor'ct. gage), lbs. | 5.150 | 5.400 | 4.32 | 3.10 | 4.420 | 5.000 |
| Draft, inches ..... | .243 | .228 | .18 | .21 | .235 | .216 |
| Temperatures, Deg. F.— | | | | | | |
| Boiler room ..... | 73 | 73.5 | 79.2 | 79.4 | 63 | 72.2 |
| Flue gases, stack..... | 337 | 296.0 | 256.0 | 286.0 | 280.0 | 343.0 |
| Gases, rear of setting.... | | | 588.0 | 591.0 | 636.0 | 637.0 |
| Feed, water ..... | 70 | 66.7 | 72.7 | 174.0 | 175 | 175.0 |
| Kind of Fuel— | Iowa Slack | Illinois Lump | Illinois Nut | Iowa Slack | Illinois Mine Run | Pocahontas |
| Proximate Analysis— | | | | | | |
| Moisture, per cent..... | 11.93 | 7.84 | 4.62 | 8.42 | 5.26 | .54 |
| Volatile matter, per cent.. | 28.06 | 34.08 | 32.00 | 30.80 | 32.40 | 15.26 |
| Fixed carbon, per cent... | 28.60 | 42.84 | 52.02 | 32.02 | 48.12 | 74.36 |
| Ash, per cent..... | 31.41 | 15.24 | 11.36 | 28.76 | 14.22 | 9.84 |
| B. t. u., per lb. as fired.. | 7691.00 | 10944.00 | 12190.00 | 8806.00 | 11609.00 | 14153.00 |
| Total fuel, lbs..... | 2128.00 | 1561.50 | 1236.00 | 2546.00 | 1538.00 | 964.00 |
| Dry coal, lbs..... | 1874.00 | 1439.00 | 1179.00 | 2319.00 | 1457.00 | 958.80 |
| Total ash, lbs..... | 587.00 | 214.00 | 149.50 | 786.00 | 241.00 | 81.00 |
| Comb'ble in ash, per cent. | 23.01 | 31.65 | 28.70 | 27.00 | 15.67 | 48.23 |
| Fuel per Square Foot Uppergrate, per Hour— | | | | | | |
| As fired, lbs..... | 16.25 | 11.80 | 16.08 | 16.26 | 11.62 | 7.90 |
| Dry, lbs..... | 14.30 | 10.87 | 9.60 | 14.80 | 11.02 | 7.86 |
| Combustible, lbs..... | 9.82 | 9.35 | 8.32 | 9.79 | 9.19 | 7.20 |
| Evaporation, Feed Water— | | | | | | |
| Per lb., coal as fired, lbs.. | 3.98 | 7.27 | 7.63 | 4.52 | 7.15 | 10.80 |
| Per lb., dry coal, lbs..... | 4.52 | 7.88 | 8.00 | 4.96 | 7.55 | 10.99 |
| Apparent Dry Steam— | | | | | | |
| Per lb., coal as fired, lbs.. | | | 7.36 | 4.08 | 6.81 | 10.48 |
| Per lb., dry coal, lbs..... | | | 7.71 | 4.48 | 7.14 | 10.52 |
| Apparent Dry Steam From and at 212 Degrees— | | | | | | |
| Per lb., coal as fired, lbs.. | 4.58 | 8.39 | 8.43 | 4.27 | 7.10 | 10.92 |
| Per lb., dry coal, lbs..... | 5.20 | 9.09 | 8.83 | 4.69 | 7.49 | 10.98 |
| Per sq. ft. h't'ng sur., lbs. | 2.00 | 2.65 | 2.28 | 1.86 | 2.22 | 2.32 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Efficiency Apparent— | | | | | | |
| Boiler and grate over all, per cent | 57.90 | 74.30 | 67.00 | 47.10 | 59.30 | 74.90 |
| Gas Analysis— | | | | | | |
| $CO_2$, per cent | 4.90 | 4.30 | 6.42 | 4.90 | 5.08 | 5.26 |
| Density of Smoke, Per Cent. of Time— | | | | | | |
| No. 0 Smoke | 63.40 | 39.40 | 52.40 | 27.50 | 44.10 | 86.00 |
| No. 1 Smoke | 27.10 | 45.40 | 22.90 | 62.50 | 28.60 | 13.20 |
| No. 2 Smoke | 8.70 | 13.30 | 18.70 | 9.80 | 20.70 | 0.00 |
| No. 3 Smoke | 0.70 | 1.80 | 5.70 | 1.20 | 6.30 | 0.80 |
| No. 4 Smoke | 0.10 | 0.10 | 0.30 | 0.00 | 0.30 | 0.00 |
| No. 5 Smoke | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Average density, per cent. | .05 | .15 | .21 | .16 | .27 | .03 |

BOILER No.2. (SIZE No. 12 KEWANEE REGULAR FIREBOX BOILER.)

| | | | | | | |
|---|---|---|---|---|---|---|
| Test number | 7 | 8 | 9 | 10 | 11 | 12 |
| Duration of trial, hrs. | 10.10 | 9.83 | 9.72 | 11.37 | 10.05 | 9.82 |
| Pressure— | | | | | | |
| Barometric, inches | 29.450 | 29.250 | 28.810 | 28.980 | 29.070 | 29.290 |
| Steam (cor'ct. gage), lbs. | 6.600 | 7.570 | 5.730 | 3.160 | 3.540 | 3.850 |
| Draft, inches | .204 | .207 | .195 | .216 | .238 | .232 |
| Temperatures, Deg. F.— | | | | | | |
| Boiler room | 73.0 | 73.5 | 79.2 | 79.4 | 63 | 72.2 |
| Flue gases, stack | 285.0 | 273.0 | 311.0 | 283.0 | 303 | 307.0 |
| Gases, rear setting | | | 628.0 | 637.0 | 631 | 597.0 |
| Feed, water | 70.1 | 67.2 | 72.3 | 171.0 | 174 | 176.0 |
| Kind of Fuel— | | | | | | |
| Proximate Analysis— | Iowa Slack | Illinois Lump | Illinois Nut | Iowa Slack | Illinois Mine Run | Pocahontas |
| Moisture, per cent | 11.93 | 7.84 | 4.62 | 8.42 | 5.26 | .54 |
| Volatile matter, per cent. | 28.06 | 34.08 | 32.00 | 30.80 | 32.40 | 15.26 |
| Fixed carbon, per cent. | 28.60 | 42.84 | 52.02 | 32.02 | 48.12 | 74.36 |
| Ash, per cent | 31.41 | 15.24 | 11.36 | 28.76 | 14.22 | 9.84 |
| B. t. u., per lb. as fired. | 7691.00 | 10944.00 | 12190.00 | 8806.00 | 11609.00 | 14153.00 |
| Total fuel, lbs | 1693.00 | 1317.00 | 1188.50 | 2030.50 | 1295.00 | 846.00 |
| Dry coal, lbs | 1491.00 | 1214.00 | 1133.70 | 1859.50 | 1226.80 | 841.40 |
| Total ash, lbs | 566.00 | 179.00 | 196.50 | 619.00 | 228.50 | 68.00 |
| Total ash, per cent | 33.40 | 13.60 | 16.53 | 30.50 | 17.65 | 8.04 |
| Comb'ble in ash, per cent. | 33.00 | 33.00 | 36.50 | 18.14 | 25.06 | 32.70 |
| Fuel Per Square Foot Grate, per Hour— | | | | | | |
| As fired, lbs | 10.28 | 8.22 | 7.51 | 10.95 | 7.90 | 5.28 |
| Dry, lbs | 9.06 | 7.58 | 7.16 | 10.03 | 7.52 | 5.26 |
| Combustible, lbs | 5.62 | 6.46 | 5.91 | 6.69 | 6.12 | 4.83 |
| Evaporation, Feed Water— | | | | | | |
| Per lb., coal as fired, lbs. | 3.04 | 6.37 | 6.55 | 4.40 | 6.69 | 9.61 |
| Per lb., dry coal, lbs. | 3.46 | 6.90 | 6.87 | 4.81 | 7.08 | 9.66 |
| Apparent Dry Steam— | | | | | | |
| Per lb., coal as fired, lbs. | | | 5.48 | 3.44 | 5.56 | 8.03 |
| Per lb., dry coal lbs. | | | 5.74 | 3.75 | 5.88 | 8.08 |
| Apparent Dry Steam From and at 212 Degrees— | | | | | | |
| Per lb., coal as fired, lbs. | 3.51 | 7.36 | 6.31 | 3.59 | 5.80 | 8.34 |
| Per lb., dry coal, lbs. | 3.99 | 7.97 | 6.60 | 3.93 | 6.12 | 8.39 |
| Per sq. ft. h't'ng sur., lbs. | 1.17 | 1.96 | 1.53 | 1.28 | 1.49 | 1.43 |
| Efficiency Apparent— | | | | | | |
| Boiler and grate over all, per cent | 43.3 | 65.2 | 56.1 | 39.5 | 48.5 | 57.2 |
| Gas Analysis— | | | | | | |
| $CO_2$, per cent | 3.00 | 5.5 | 4.5 | 5.22 | 4.37 | 4.4 |
| Density of Smoke, Per Cent. of Time— | | | | | | |
| No. 0 Smoke | 2.10 | 0.50 | 8.80 | 5.40 | 0.00 | 76.00 |
| No. 1 Smoke | 51.30 | 54.80 | 54.10 | 40.70 | 44.00 | 16.40 |
| No. 2 Smoke | 36.30 | 33.40 | 29.40 | 33.10 | 38.50 | 6.10 |
| No. 3 Smoke | 9.30 | 8.40 | 5.40 | 14.80 | 14.20 | 0.50 |
| No. 4 Smoke | 0.80 | 2.60 | 2.30 | 1.00 | 3.30 | 0.00 |
| No. 5 Smoke | 0.20 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| Average density, per cent | .31 | .32 | .27 | .33 | .35 | 0.60 |

## A Good Cheap Concrete Fence

A concrete fence which should prove of interest to our readers was recently designed by R. V. Moss, city surveyor of New York city, for the Glen Ridge tennis courts. It is strong and durable, of neat appearance, and can be quickly erected at low cost.

At 12-ft. 1-in. centers 3-in. I-beams 12 ft. 6 in. in length were sunk in the ground to a depth of 2 ft. 6 in., leaving 10 ft. of post above the surface. The flanges of these beams were wrapped with expanded metal lath to a height of 6 ft. above grade to carry cement plaster. A 2 by 3-in. spruce bottom rail was placed between the posts along the ground and a top rail of the same size at a height of 6 ft., with Rib-Trus reinforcing plates, manufactured by the Berger Mfg. Co., Canton, Ohio., extended to cover the space between. The concrete was then applied on the reinforcing plates to a thickness of 3 ins.

A FENCE *of concrete and wire of good design.*

Above the reinforced concrete portion of the fence, wire netting is fastened to the height of 4 ft., making the entire height of the fence 10 ft., 6 ft. of which is concrete and the remainder wire.

The cost of this type of fence is extremely low, especially for the concrete portion of it, which, in this case, is increased by the fact that the I-beam posts extend 4 ft. above the concrete to carry the netting.

The concrete portion alone cost about 25 or 30 cents per sq. ft., including the contractor's profit, which made the cost of the 6-ft. fence from $1.50 to $1.80 per lineal ft. The average fence costs from $2.00 to $2.50 per foot, is neither as easily nor as quickly erected, and is seldom as strong and durable.

## Machinery in Highway Construction

*By A. N. Johnson, State Highway Engineer of Illinois.*

Experience in Illinois shows that hauling with a tractor outfit is cheaper than team hauling for the same distances, and that the economy increases with the length of the haul up to the maximum for which data have been obtained in the work of the commission. The cost per cubic yard for hauling crushed stone with the tractor outfit is about 60 per cent. that of team hauling for one mile and about 40 per cent. of the cost of team hauling for distances of three miles. This cost includes the pay of the operator for the engine, who is paid straight time regardless of the conditions of the weather and whether the job is running or not, the cost of the fireman who is paid only for the days when the outfit works, the cost of fuel, oil and supplies for the steam engine, and the cost of maintenance.

During the average season in Illinois from May 1st to December 1st, a tractor outfit can be used for hauling over earth roads only about 50 per cent. of the time. A hauling outfit costs approximately $4,000, and in the work of the commission, the cost of maintenance has been $100 per season.

The construction of concrete roads requires a complete outfit of machinery. A steam or gasoline roller weighing about ten tons will be required, and in addition there will be certain special machinery for handling the concrete.

The mixer should be a batch mixer and should load from in front and discharge

from the rear. The mixer should be self-propelled and for this class of work experience shows that the steam-driven machine is more satisfactory than the gasoline-driven.

In country road work it will also be found that the water supply system will require special attention. The water will be obtained from ponds, reservoirs or from wells, and must be pumped to the mixer. This will necessitate a pumping outfit and a system of piping arranged alongside the road so that the hose from the mixer can be attached at any place. The pumping outfit should be of ample capacity, certainly capable of delivering three or four times the amount ordinarily required by the mixer itself, because in hot weather a large amount of water is necessary for wetting down the subgrade before the concrete is placed and for sprinkling the concrete behind the mixer.

In addition to the concrete apparatus there will be required templets for striking the road surface. These usually consist of two boards 1 inch or 1¼ inches thick, cut to the desired crown for the road and fastened to blocks parallel to each other and about 6 inches apart. They are drawn along the top of the forms at the edge of the concrete. For floating the surface after it has been struck off to the desired crown, a float made of a thin board of sufficient length to reach the entire width of the pavement being constructed and 1 foot on each side is bent to the crown of the finished pavement and held by means of ribs to which it is attached. This float is drawn with a combined forward and crosswise movement in such a way as to float the finished concrete and at the same time strike it down to the desired shape.

There will also be required with the concrete outfit the ordinary tools used in concrete work, that is, wheelbarrows, shovels, picks, tampers and similar tools. The cost of a complete concrete road outfit can be made anything desired, but the essentials for placing the concrete and furnishing the water supply, including a mixer having a capacity of about 1,000 square yards of 6-inch pavement per day with all auxiliary apparatus and tools, will cost about $2,700.

We use Koehring street paving mixer very extensively in our work and this machine very readily averages from 600 to 800 square yards of 7-inch concrete for a 9-hour-day. This average, however, has been made with a gang of men that could not be called well trained.

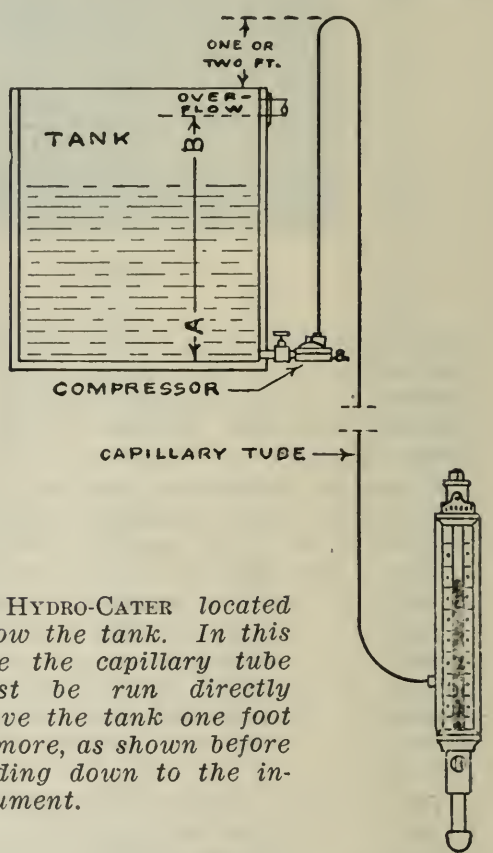
Our Koehring mixer has a rated capacity of about 14 cubic feet to one batch of material.

I believe a well-trained gang should make an average of 800 to 900 square yards. The gang consists of one man running the hoisting apparatus on the mixer, one man running the delivery bucket, ten men shoveling into the mixer, working in relays of five each, two men on forms, two men finishing, one man spreading canvas and keeping same moist and moistening the work already done, and one superintendent.

It is to be understood that the road bed has been previously shaped and the gravel and sand hauled on the work and the cement delivered. With the exception of the cement delivered, this work may be all done before the mixer arrives. The delivery of the cement will require two or more teams, depending upon the distance to be hauled, and requires one man opening the sacks and dumping same into the mixer.

## The Hydro-Cater

A new hydraulic indicator called the Hydro-Cater is herewith shown. This instrument is for indicating the depth of water or other liquids, and can be located any distance above, below, or from, the liquid to be indicated. It is adapted for tanks of all kinds, reservoirs, water towers, wells, pumps, filtering plants, etc.




THE HYDRO-CATER *located below the tank. In this case the capillary tube must be run directly above the tank one foot or more, as shown before leading down to the instrument.*

The instrument itself is very simple, being free from any mechanism or moving parts. It shows, at all times, the

exact amount of water in the tanks or water towers in feet and inches or gallons.

The contents of the tank are shown by a brilliant red liquid or mercury, in a glass tube; the scale reading is ten inches high for the standard instrument, which represents the full depth of tank, whether it is 2 feet or 100 feet, as each gage is especially calibrated for the depth of tank and the specific gravity of the liquid to be indicated. The manufacturers make them up with longer glasses, up to 72-inch readings, if desired.

The instrument is fastened to the wall of an office, and an ⅛-inch outside diameter capillary copper tube, annealed, and very flexible, is run to the tank like an electric wire. It may be run above or below the ground; it contains only air and cannot freeze or stop up. One end of this hollow wire is attached to the top of a casting 6 inches in diameter, which is called the compressor, and is attached to the bottom and outside of tank as shown, or may be simply lowered thru the top, to the bottom on the inside.

The static pressure of the liquid in the tank forces the trapped air in the compressor and tube line against the indicating liquid in the instrument, and causes it to rise in the glass tube in exact proportion to that in the tank.

They serve as well to indicate the rise and fall of water in rivers, dams, and flumes, and are made for registering oils, gasoline, syrups, spirits and chemicals. They are specified and used by the United States Navy, and are manufactured by the Sterling Gauge Co., 132 Larned St., East, Detroit, Mich.

## Reading, Pa., Water Works Improvements

The improvements recently made to the municipally owned water works of the city of Reading, Pa., consist of the building of two slow sand filtering plants and the covering of two distributing reservoirs.

The Penn street reservoirs, consisting of two basins having a combined capacity of 5,647,000 gallons, were covered with groined concrete arches supported upon concrete pillars. The arches are semi-circular in section, have no reinforcing metal imbedded and are six inches in thickness at the crown. To carry the unbalanced thrusts occasioned by live loads over one-half of the arches, concrete struts were introduced from pillar to pillar, and then to the end walls, which in turn are supported by the earth backing. The groined arches are covered with 18 inches of boiler cinders supporting a 6-inch concrete floor, used for roller skating and playground purposes in summer time, and for ice skating in the winter.

FOUNDATION AND COLUMNS *ready for Arches.*

The other (Buttonwood street) reservoir, situated on the slope of Mount Penn, was covered with reinforced concrete floor slabs supported by reinforced concrete beams and girders on columns. The reservoir was also relined to make it water-tight. It holds 926,000 gallons of water.

Both reservoirs were covered to prevent the growth of algae in the filtered water stored therein, and to prevent polluting matter from being blown or thrown into the water.

Eight thousand five hundred and forty-two and one-fourth barrels of Lehigh Portland cement were used in the improvements to the Penn street reservoir and one thousand and thirty-six barrels in the Buttonwood street reservoir. Fehr & O'Rourke, contractors of Reading, Pa., did the work on both reservoirs.

The slow sand filters for the Bernhart supply consist of six filtering beds 71x138.5 feet each. The capacity of each bed is three-quarters of a million gallons per day.

The filters are built upon clay soil, with a 5-inch concrete slab bottom, concrete piers and concrete groined arches. The arches are covered with 2 feet of soil and sodded. Eight thousand, five hundred and thirteen barrels of Lehigh Portland cement were used in the construction of these filters. Albrecht & Leader, of Reading, Pa., were the contractors for this work.

## Paving in Springfield, Mo.

*By C. E. Phillips, City Engineer.*

During the year 1912 we constructed five different kinds of pavements but from experience we have had to date it is our belief that Sarcolithic Mineral Rubber pavements will be more satisfactory in the long run as this pavement seems to be the most highly developed and satisfactory form of asphalt pavement for general purposes. It is exceedingly tough and rubbery and when properly laid shows little sign of wear even after a very lengthy period. Our experience has been that it withstands diverse traffic conditions and is least effected by temperature ranges. It has a dark appearance and is practically noiseless and dustless. The surface while smooth is more gritty than most asphalt pavements as a larger stone is used in its wearing surface and consequently is less liable to prove slippery. During the year 1912 the Jarrett-Richardson Paving Co. laid the following Sarcolithic Mineral Rubber pavements in this city, in all of which pavements Sarco asphalt was used:

| Street and Distance | Kind | Width Paved | Lin. Ft. | Sq.Yds. |
|---|---|---|---|---|
| Harrison, Jefferson to Mrytle | Asphaltic Concrete | 27 feet | 1803.45 | 5052.00 |
| Jefferson, Elm to Madison | Sarco | 36 feet | 1840.00 | 7496.76 |
| O'Fallin, Market to Main | Asphaltic Concrete | 18 feet | 374.40 | 736.40 |
| Main, Mt. Vernon to Philips | Asphaltic Concrete | 24 feet | 1249.10 | 3316.12 |
| Myrtle, Cherry to Monroe | Asphaltic Concrete | 24 feet | 896.50 | 2443.13 |
| Grant, Commercial to Atlantic | Asphaltic Concrete | 40 feet | 1334.60 | 4116.63 |
| Main, Phelps Ave. to Nichols St. | Sarco | 36 feet | 2344.40 | 6868.01 |
| Walnut, Jefferson to National Blvd. | Sarco | 36 feet | 4067.70 | 16371.10 |
| Cherry, Jefferson to Dollison | Sarco | 36 feet | 2225.60 | 8994.13 |
| Cherry, Dollison to National Blvd. | Sarco | 28 feet | 1750.40 | 5509.59 |
| Market, Walnut to Phillips | Asphaltic Concrete | 30 feet | 2281.40 | 6710.70 |
| Fremont, Cherry to Catalpa | Asphaltic Concrete | 24 feet | 3936.80 | 9635.51 |
| Lombard, Holland to Kings Highway. | Asphaltic Concrete | 24 feet | 1337.70 | 3445.72 |
| Belmont, Holland to Kings Highway. | Asphaltic Concrete | 24 feet | 1337.70 | 3628.63 |
| Main, Walnut St. to Mt. Vernon | Asphaltic Concrete | 36 feet | 1053.00 | 3895.66 |

During the year 1912 we laid 45,000 square yards of the Sarcolithic Mineral Rubber pavements in the city of Springfield, Mo., as well as considerable of this same type of pavement prior to above year. Pavements which have been down for a period of two years show no signs of wear whatever. Sarcolithic Mineral Rubber pavements are extremely popular in this community as the larger stone

WALNUT STREET, *Springfield, Mo., paved with Sarcolithic Mineral Rubber.*

which is used in their wearing surface give it more body than asphaltic concrete. Our experience has been that it lasts longer and does not crack up in hot weather. Its gritty surface makes it the most reliable and safest for the travel of horses and autos.

## The Friend Power Spraying Outfit

The Friend Mfg. Co., of Gasport, N. Y., claims the distinction of building the first gasoline power sprayer in 1901. The business has developed into one covering the whole world.

A sprayer outfit includes a supply tank, which may be of any transportable size but practically should be about 200 gallons capacity. There must be a mechanical agitation in the solution tank running smoothly and all the time. There must be pressure to force the solution out thru the special nozzles which distribute it over the foliage. These necessitate a truck, a tank, a gasoline engine,

Dudley Avenue, Westfield, N. J.

# A Tarvia Town

THERE are many towns in this country which began with Tarvia years ago and finding it successful have extended its use on their roadways year by year as a matter of fixed policy. Such a town is Westfield, N. J., which now has 19 miles of tarviated streets.

Mr. A. W. Vars, the town engineer, reports that the "Tarvia B" treatment on all these streets averaged 1¾c. per square yard for the season of 1912; compared with the cost of keeping down the dust and maintaining the road surface by any other method, this is a very low figure.

The roads have been free from dust and have not been seriously impaired by automobile traffic.

Tarvia acts as a binder and cements the road surface firmly together in a plastic matrix. Automobiles do not hurt such a surface but roll it down smoother.

The amount of new stone screenings needed for surface maintenance is greatly reduced by the Tarvia treatment and the road keeps in better condition. The longer the Tarvia treatment is maintained, the less the annual cost.

*Booklets on request.*

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland
Cincinnati Minneapolis Pittsburgh Seattle Corey, Ala.
The Paterson Mfg. Co., Ltd.—Montreal, Toronto, Winnipeg, Vancouver. St. John, Halifax, Sydney, N. S.

TRADE B MARK

hose, nozzles, ladder or elevated platform and various valves and automatic appliances.

The Friend Mfg. Co. supply outfits of various capacities and capabilities, such as the new Western Friend with 250 gallon tank; the orchard model, 200 gallons capacity; the hilly orchard model with low tank so that it will not overturn; still smaller models for one horse; the high pressure park sprayer for shade trees with low hung tanks of 200 gallons capacity, high pressure pump and hose, long spray poles, etc. Hand outfits for wagon or cart are also supplied, as well as any of the separate parts.

The company will supply any desired detail regarding their outfits on request. They are specially applicable to street and other city trees as well as to park and orchard trees.

## Protecting Trees From Insect Pests

A booklet has come to hand recently which gives full information about methods of protection of trees and shrubs from their insect enemies, which will be of great value to park and tree conservers as well as to orchardists.

It contains a spraying calendar which gives the time for spraying with each kind of insecticide required for the pests which appear for each of some twenty kinds of trees, bushes and vegetables, and the materials and methods of the various insecticides and fungicides.

The apparatus used for spraying is also fully described and illustrated, showing hand and power sprayers of many different designs and capacities for every sort of duty required.

Another good book is entitled "Spraying for Profit," and answers any probable question as to materials, methods and results.

These books are published by the Deming Co., Salem, O., and will be supplied on request.

They supply also all sorts of hand and small power pumps and force pumps, air compressors and hydraulic rams and the Deming hydro-pneumatic system of water supply for furnishing water under pressure to single houses and their service buildings.

Full information will be supplied by the company on request.

## Trade Notes

The mayor of a small Iowa city is asking for applications for position as manager and superintendent of an electric lighting plant, at $85 to $100 a month. Letters to this office will be forwarded to him.

The Electric Railway Equipment Co. have removed their New York office to the Hudson Terminal building, 30 Church street.

The F. A. Pease Engineering Co., civil and consulting engineers, have moved their offices to the Marshall building, Cleveland, O.

J. F. Druar, consulting engineer, The Oscar Claussen Engineering Co., St. Paul, Minn., has been retained to draw plans and specifications for the municipal waterworks system of Maple Lake, Minn., the work to consist of water mains, valves, hydrants and 50,000-gallon tank on a 115-foot tower. Notice of date of letting later. Plans and specifications were ready April 15, check for $2.50 to cover cost of reproduction. Plans and specifications for a municipal electric light plant for Mayville, N. D., are just ready.

The Sefton Manufacturing Company, Chicago, has awarded a contract to the Raymond Concrete Pile Company, New York and Chicago, for constructing a 600-foot reinforced concrete bulkhead dock at their plant on the south branch of the Chicago river, Chicago. George R. Morris, architect, Baltimore, Md., has awarded them contract for placing standard Raymond concrete piles and footings for the Avon apartment house, and Buffalo has let them contract for 600 piles for foundation of Venturi meter and valve house at Porter avenue pumping station, and for foundation of Hutchinson high school.

The Merritt Hydraulics Co., 1211 Fidelity building, Philadelphia, Pa., have purchased the business of the hydraulics department of Merritt & Co., of Camden, N. J., and now make and sell the Merritt, Weand and Priestman sewage siphons, flush tanks, sprinkler nozzles, automatic lifts and screens, pneumatic ejectors and other sewage disposal apparatus.

William F. Morse, 90 West street, New York City, notifies the trade that he has no interest in the Atkinson-Morse Destructor Co., of New York, and is not responsible in any way for its debts, contracts or obligations of any nature, and that that company has no right to the use of his designs or patents, or the use of his name in connection with the sale of rights to build or contracts for the construction of garbage destructors or incinerators.

## Trade Publications

Stone and Webster, electric railway and lighting properties for 1913. Leather, 75 pp.

J. W. Howard, consulting engineer on roads, streets and pavements, 1 Broadway, N. Y., issues a number of very helpful circulars on specifications, tests and

Placing Baker Armored Joint on Smith Avenue, Hamtramck, Michigan.

# BAKER ARMORED CONCRETE PAVEMENT

(Patent Applied For)

IS THE MOST DURABLE PAVEMENT KNOWN

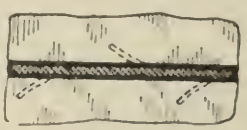
**BAKER ARMOR PLATE**

—insures true and even joints absolutely flush with the balance of pavement. No ruts or depressions at this point.

—rolled into shape to fit standard curves of street pavements. Special curves rolled to order.

Our improved labor saving methods are protected by patents applied for, but we have no desire to restrict their use by those purchasing our Armor Plates, and we welcome any requests for information that may enable the contractor to produce better results, or perform his work in a more economical manner.

**1,249,678 Square Yards**



**NOW IN USE IN FIFTY CITIES. SEND FOR THE LIST.**

***Illustrated Particulars, including specifications, on request.***

THE R. D. BAKER COMPANY

DETROIT, MICHIGAN.

ME

inspection for brick, asphalt, and wooden block streets and on census of traffic on streets and roads.

*Crane-ing* is a lively little monthly distributed to advertise the Cleveland Crane & Engineering Co., Wickliffe, O.

A recent circular of the Kewanee Boiler Co., Kewanee, Ill., gives a list of modern school buildings in which their fire-box boilers have been installed by the Bryce Heating & Ventilating Co., in Michigan, Ontario, Indiana and Ohio and pictures of a dozen of them.

The Andrews Heating Co., Minneapolis, Minn., have in their catalog a steel septic tank for use of private houses, which may be placed in the basement or buried in the ground and discharge into stream or filter or underground gravel bed.

The American Asphaltum and Rubber Co., Chicago, Ill., calls attention in a circular letter to their intention to appeal from the decision of Judge Kohlsaat against them in the claim of their infringement of the Culmer patents and that a heavy bond is not required in connection therewith.

The Gier & Dail Mfg. Co., Lansing, Mich., distribute a handsome advertisement of their sanitary drinking fountains, which are unique as the bubbler is movable and as convenient to use as a cup.

Barrett specification roofs are the standard, because they are so thoroly well advertised and meet every condition provided for in the specification under which the Barrett Mfg. Co., demands that they be constructed.

The Consolidated Expanded Metal Co's, Pittsburg and New York, send some data and plans for reinforced concrete bridges and culverts for insertion in their catalog, which include the standard designs for Pennsylvania and New York highways.

The Jennison-Wright Co., Toledo, O., send circulars of their Kreolite hexagonal and other forms of creosoted wood paving blocks for factory and bridge floors, area ways and street pavements.

Stone and Webster's annual manual of the companies under the management has been distributed.

D. B. Luten, Indianapolis, Ind., is distributing copies of the latest decision in favor of nine of his patents for reinforced concrete arches and bridges, made by the U. S. District Court for Indiana against John W. Barlow.

A story with a moral is given in "The Autobiograph of a Cement Sack," published by the Universal Portland Cement Co.

The New York Polo grounds during the world's series ball games are shown in a card advertising Medusa stainless white portland cement used in building the grand stand and the fences. A new booklet describes the successful use of Medusa waterproofing and is full of useful information.

*The Long Green* published periodically by the Coldwell Lawn Mower Co., Newburg, N. Y., is devoted to their gasoline motor and hand lawn mowers. It is handsomely printed and illustrated.

Rocmac Limited, Box K, Thorold, Ont., distribute a circular descriptive of their pavement, which is fitted for light traffic streets and country roads.

Refined asphalt for municipal paving plants is the subject of a pamphlet issued by the American Asphaltum and Rubber Co., Chicago, Ill., which demonstrates by comparisons of cost the economy of purchasing asphalt which is high in bitumen as are both the Gilsonite and the asphalt flux which are used in the various "Pioneer" products. The booklet is well worth reading and will be sent on request.

Dolarway pavement is fully described and illustrated in a handsome booklet which will be sent on request by the Dolarway Paving Co., Whiteball building, New York City.

The new Beale-Moore hydraulic operator for large gate valves is well illustrated in a booklet issued by the Self-Operating Valve Co., Woodward building, Washington, D. C.

C. L. Farnsworth, 33 Central street, Boston, Mass., sends a convincing letter to the effect that the success of tar concrete street crossings in New England towns in evidence that the whole street can be covered the same way at low cost for construction and maintenance using Ma-Drite.

The Kelley Island Lime & Transport Co., Cleveland, O., is distributing some handsome circulars about "Rubber-Stone," which is a road building and repairing material made by the Howe method of combining limestone screenings with deliquescent chlorides. The result of its use is the maintenance of good road surfaces at low cost. Send for the detailed information.

One of the most thoroly prepared books on road materials that has appeared is the new 100-page description of "Triangle Mesh Wire Reinforced Concrete Pavements and Roadways," issued by the American Steel and Wire Co., Chicago. It shows why reinforced concrete pavements can be and are good pavements.

The Jewell Bulletin gives full information about the Jewell Nursery Co., Lake City, Minn., which supplies park, street and shade trees as well as fruit trees and plants.

425

# MUNICIPAL ENGINEERING

**The World's Leading Municipal Publication.**

SCHOOL GARDEN, *Oakland, Cal.*

VOL. XLIV. JUNE, 1913. No. 6.

*The business man who does not annually charge off depreciation on his mechanical equipment ultimately finds it necessary to go deep into his profits to put his plant in efficient running order. The man who fails to keep himself informed on the up-to-date developments in his field finally has to charge to his personal-depreciation account a sum difficult to estimate.* MUNICIPAL ENGINEERING *keeps those interested in municipal improvement affairs alive to all that is valuable and eliminates personal depreciation.*

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# THE OPERATION OF PLANT AT

PANORAMIC VIEW OF SEWAGE

*The sewage flows from the tower thru pipes and is sprinkled on the filter beds, the sprinklers being seen in full action. The effluent from the filters flows back to the tower and thence to the final sedimentation basins seen in the foreground, thence thru the manhole on the left into the Scioto river.*

AT the time the sewage purification plant at Columbus, Ohio, was completed MUNICIPAL ENGINEERING published an article, vol. xxxv, p. 211, giving a full description of the process and the plant installed to carry it out. After several years of operation it will be of interest to note the successes and failures in the operation of the plant and the suggestions of improvements, made by C. B. Hoover, the chemist in charge of the sewage purification works, in his report for 1912.

He says that "today the opinion seems to prevail that the difficulties of successfully treating sewage decrease with the rapidity of its collection. At Columbus the length of the sewers, the flat grades, the presence of grit dams and consequent septic pools, and pumping, all combine to increase the difficulties of treatment. Large quantities of grit are washed into the sewers where the combined system of sewerage is in use, and this grit has been a source of trouble at both the pumping stations and purification works."

### Collection of Sewage.

It is necessary to collect the sewage from the combined system by interceptors and to pump it to the purification plant. The east side pumping station, on Main street near Alum creek lifts the sewage from a comparatively small district 58 feet over the divide into the main system, and the main sewage pumping station on the west bank of the Scioto river a short distance below Strimmel road, elevates all the sewage of the city an average of 18 feet thru a 48-inch cast-iron force main into the septic tanks, 1.2 miles down stream. The sewage can be discharged into the river unpurified when it is in flood and so the main pumping station can be used at such times to lift storm water into the high river from the low district west. The cost of pumping at the east side station, using natural gas for fuel, was $2.734 to $3.240 per million gallons pumped and that at the main station, using coal for fuel, $1.114. The former is the cheaper when difference in lift is considered.

The removal of sand from the sewage before pumping has always been a serious practical difficulty. Sand catchers are in use and sand cleaning apparatus is being installed.

# SEWAGE DISPOSAL COLUMBUS, O.

PURIFICATION WORKS AT COLUMBUS, O.

*Sedimentation tanks are at the right in the background. At the right of the stairway on the extreme right are the primary sedimentation tanks. At the left of the stairway are the secondary tanks, the discharge from which flows to the tower on the left-hand page.*

### Escape of Sewage

The capacity of the pumps in the main station is 10,000,000 gallons a day. The sewage of the city is estimated to be about 15,000,000 gallons a day, of which 2 1/3 million gallons reach the river directly at the 25 points where the sewage is intercepted from the sewers discharging storm water into the river. This wastage of sewage directly into the river is due to clogging of the intercepters and their connections with the sewers. The amount actually reaching the pumping station is still greater than the capacity of the pumps. In all something like 5,000,000 gallons of sewage reaches the river unpurified, or one-third of the total amount.

This is something more than one-half the amount which produced the nuisance that caused the construction of the purification plant. It is evident, therefore, that there is some nuisance now created in the river at low water stages in hot weather, for which the disposal plant is not responsible.

### Purpose of Sewage Treatment

The purpose of the treatment of the sewage is to prevent the gross pollution of the Scioto river below the city, and the evidence of such pollution consists in the blackening of the water, the exhaustion of the dissolved atmospheric oxygen beyond certain limits, the presence of floating masses of sewage solids, and the emission of foul odors. The bacterial pollution of the stream is not so important because there are no public water supplies taken from the river below the city. In order to prevent a nuisance-producing degree of pollution in the river it is necessary to remove entirely certain constituents of the sewage and to convert other constituents from an unstable to a stable condition thru chemical and bacterial agencies. The equipment which has been provided for the treatment of the sewage consists of preliminary sedimentation tanks, hand-operated sprinkling filters and final sedimentation basins. The modification of the sewage which is effected by its treatment at the works, and a varying dilution which the river provides, are the two agencies which are relied upon to prevent the production of a

nuisance. At certain times the dilution which the river provides is so great that treatment of the sewage is not necessary at all. At other times, the slight purification which is effected by plain sedimentation is sufficient, and the degree of modification of the sewage which must be effected by the works increases as the dilution decreases, until the critical stage is reached during the "low water - warm weather" season of the year when the small dilution, sluggish flow and warm weather tax the purifying capacity of the works to the limit.

CENTRIFUGAL PUMPS *in main sewage pumping station, Columbus, O., which force all sewage to the sewage treatment works.*

### Preliminary Tank Treatment

The purpose of the preliminary tank treatment is to effect a removal of the coarser solids, which results in a partial purification of the sewage and prepares it for the oxidizing process which follows. When the untreated sewage is discharged from the force main into the tanks, the velocity of flow is so greatly reduced that the solids settle to the floors of the tanks and this deposit is known as sludge. The two problems which are involved in the tank treatment are the production of a satisfactory effluent and the disposal of the sludge. During the year 1912 one small and one large tank were kept in service and the average total period of flow, based upon a complete displacement of the liquor, was 4.86 hours. The average period of flow for the small or detritus tank was 1.04 hours with an average velocity of flow of 2.40 feet per minute, and for the large tank, 3.82 hours with an average velocity of 1.14 feet per minute.

As in previous years, it has been found that the efficiency of tank treatment decreases with the length of the time that the tanks are kept in service and that it is necessary to shift the tanks when the stage of intensely active sludge decomposition has been reached. The service record of the tanks for the year 1912 is as given in table at bottom of page.

The works were out of service from June 1 to 20 because of the cleaning of the sand catcher at the main sewage pumping station.

The operation of the works was discontinued after October 24 because of a shortage of funds.

For the year the period required for sewage to flow thru the two tanks averaged 4.86 hours, varying during the 7 months of operation of the tanks from 3.9 hours in June to 5.7 hours in April. The suspended matter removed averaged 55.5 per cent., varying from 49 per cent. in October to 74 per cent. in June. The deficiency in oxygen in the liquid is shown by an average of 26 per cent. reduction in the percentage of oxygen consumed from potassium permanganate, by the passage of the liquid thru the plant, and the same reduction in oxygen consumed as dissolved oxygen.

Mr. Hoover states that the present preliminary treatment tanks are not satisfactory and recommends that they be converted into the two-story type, because such tanks will reduce clogging of the nozzles of the sprinkling filters, and the offensive odors, can be cleaned without throwing them out of service, and offer better sludge-disposal facilities. He estimates the cost of the reconstruction at $50,000.

| Date in Service. | Tanks in Service. | Total Days in Service. |
|---|---|---|
| April 13th to May 28th, inclusive | 1 and 5 | 46 |
| May 29th to May 31st, inclusive | 3 and 5 | 3 |
| June 21st to July 31st, inclusive | 1 and 5 | 41 |
| August 1st to September 5th, inclusive | 2 and 6 | 36 |
| September 6th to October 11th, inclusive | 3 and 5 | 36 |
| October 12th to October 24th, inclusive | 4 and 6 | 13 |

Tanks Nos. 1, 2, 3 and 4 are the small tanks and Nos. 5 and 6 are the large ones.

### Sludge Disposal

Septic tank sludge was flushed to the river on the 17th and 18th of June, at which times No. 1 and No. 5 were cleaned and the river was ten feet above the low water stage. On August 23, tank No. 5 was cleaned by flushing to the gravel pit north of the tanks, and on October 11, tanks No. 4 and No. 6 were cleaned in the same way. The drying of the sludge which was flushed to the gravel pit was effected by evaporation and the percolation of the excess water thru the porous gravelly bed of the pit, but as this bed was not prepared for sludge disposal purposes it only serves as an emergency or temporary device. The sludge has never been removed from the bed of the pit because of the unevenness of the ground, and when the pit becomes filled with ground or surface water during floods, the sludge again becomes waterlogged. Mr. Hoover recommends sludge drying beds of the best type for immediate construction, to be used this summer, at a cost of $25,000.

PRIMARY SEDIMENTATION TANK *of Columbus sewage purification plant, showing the deposits of sludge which must be removed. The sewage inlets are at the farther end.*

### Sprinkling Filter Treatment

After the coarser solids of the sewage have been removed by sedimentation in the preliminary treatment tanks, the liquor is ready for the purification process, which consists of an oxidation of the soluble constituents and as a result of which they are converted from an unstable polluting nature to a stable non-polluting condition. The oxidation is effected by chemical and bacterial agencies and the sprinkling filter is simply a device which promotes such activities. The spraying of the tank liquor in the air favors the release of certain offensive gases and also promotes aeration or the absorption of oxygen from the air. The trickling of the liquor thru the 5½ feet of broken stone soon results in the stones (particularly those in the surface foot) being coated with a slime which is found to consist of organic matter, the oxidizing species of bacteria, and many species of microscopic and larger plant and animal organisms. The oxidation and consumption of sewage material is the result of the combined activities of these different agencies and the success of the treatment will be governed by the concentration and character of the applied sewage, the rate of application per unit of area, the uniformity of surface distribution, the size and depth of the filtering material and the temperature of the sewage and air. The temperature of the sewage and air is not under control, and the size and depth of the filtering material are constant factors. During the past year the

SPRINKLING FILTERS *of Columbus sewage purification plant, showing the channels thru which sewage flows under pressure to the upright pipes with sprinkler heads on their tops, the broken stone filling of the filter being dumped in at the left, the semi-cylindrical collectors of the filtrate under the broken stone, which discharge into collecting galleries running to the outlet channel.*

only effort which was made to improve the filter effluent was a reduction of the rate of application by reducing the size of the nozzle orifices.

The sprinkling filters took care of an average of 12,480,000 gallons a day, varying from 11,300,000 in May to 14,840,000 in June. The filter area in service was ten acres, except in April and May it was 8.75 acres. The average time the filters were in operation was ten hours a day; the average volume actually applied to the filters was 1,290,000 gallons per acre per day, and the average rate of filtration was 3,060,000 gallons per acre per day. The suspended matter in the liquid was reduced by the filters 19 per cent. There was a reduction of 61 per cent. in the oxygen consumed from potassium permanganate and of 81 per cent in dissolved oxygen consumed.

But four of the six filter bed units have been constructed and they are just able to take care of the sewage reaching them. If all the sewage reached the purification plant, they could not do the full work required, and new sewers are built each year. Mr. Hoover therefore recommends construction of the other two units at a cost of $120,000. He also recommends installation of an automatic dosing device, which he thinks would increase the efficiency of the filters and reduce the number of men employed, resulting in a saving of $700 to $1,000 a year.

### Final Sedimentation

The purpose of the final settling basins is the removal of the coarser suspended matter from the sprinkling filter effluents. It has been the practice at the works to use the final basin only during the late spring, summer and early fall months, or, in other words, during that time of the year when floods in the river are not to be expected. Sludge deposits in the river in the cold weather are not apt to be serious from a nuisance-producing point of view and they are broken up and flushed away by the spring floods before the return of warm weather. During the past year the final settling basins were not in service because of the construction work which was in progress and the total efficiency of the works was somewhat decreased thereby.

When these final settling basins were designed and built it was thought that the

sludge which would be deposited therein would be fairly stable or inert and that consequently they would need to be cleaned rather infrequently. It seemed wise at that time to sacrifice floor slopes in order to get greater capacity and consequently the floors were built with scarcely any slope at all. Later experience showed that the basins would need to be cleaned with greater frequency than was at first expected and the flat floor grades made the cleaning of the basins a tedious and difficult job. The basin which was rebuilt had been used for the storage of sludge from the preliminary treatment tanks when they were cleaned during low river stages and the removal of this sludge was included in the contract as a part of the required excavation. The work consisted of removing all of the old inlet wall and replacing it with a new wall and a new concrete inlet weir; removing all of the old floor and replacing it with a new floor with greater slopes and provided with a branched instead of a single sludge drain; removing the circular outlet weir and replacing it with an outlet weir wall and collector channel along the east retaining wall; relaying about 185 lineal feet of 21-inch vitrified drain pipe; laying about 1,360 lineal feet of 4-inch and 10-inch cast iron pipe, and dressing and seeding certain portions of the slopes around the basin. The inlet and outlet weir walls and the ridge floor in the center of the basin carry the 4-inch city water lines which are provided with 2½-inch hose valves and which are a part of the improved flushing facilities. The 10-inch cast iron pipe is so arranged that the supernatant liquor in the basin may be drawn off thru it at times of sludge removal. The inlet weir wall is provided with sluice gates which may be used for sludge flushing purposes.

*The ordinance regulating the keeping of dogs in Memphis provides that a dog must be kept seventy-six hours. To simplify the problem of checking the time a dog is kept, the dog pound is built in four sections, numbered 1, 2, 3 and 4. When received, a dog is placed in section 1, and at intervals of twenty-four hours is transferred to numbers 2, 3 and 4. Section 4 is the death chamber, which is of concrete, 6x6x6 feet with airtight doors. Gas admitted from an 11-inch pipe for a period of 2½ or 3 minutes is sufficient to dispatch a full charge of condemned dogs. The total cost is less than 5 cents. Owners are allowed to redeem their dogs upon payment of $1.00 pound fee and $1.25 license fee.*

# CONSTRUCTION OF THE GRAND RAPIDS FILTRATION PLANT

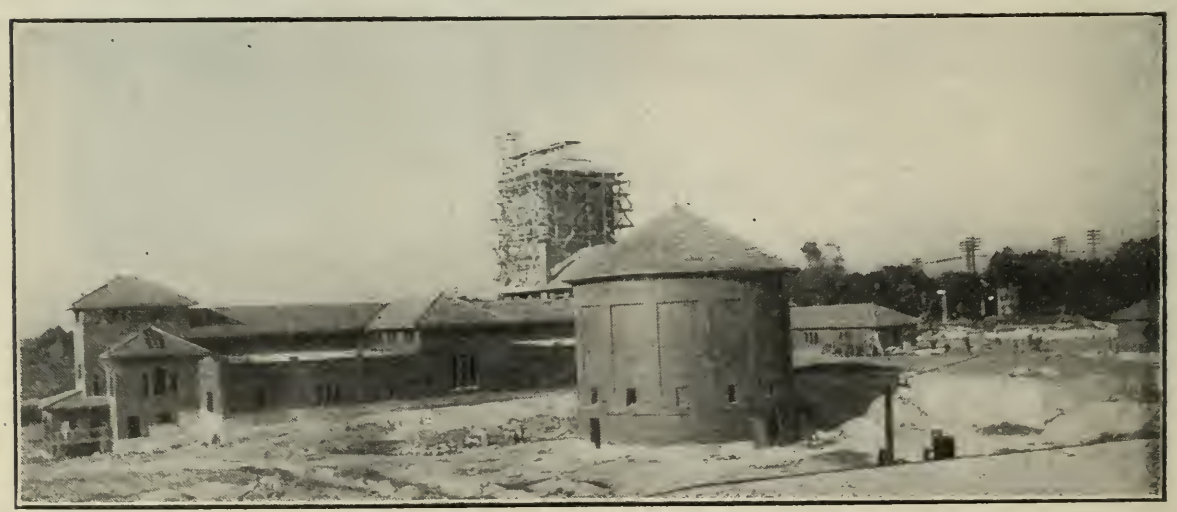
*By L. D. Cutcheon, Secretary and General Manager, Board of Public Works, City of Grand Rapids, Mich.*

AFTER nearly three years of planning and constructing, the city of Grand Rapids, Mich., has completed a plant for purifying and softening its water supply. Many novel features in the details of the construction, and later in the operation, were found necessary and introduced, and it is believed to be one of the most complete filtration plants now being operated in this country.

The city uses an average of fourteen million gallons per day, supplying nearly 115,000 people with an average of 112 gallons per capita, and has for years drawn its water supply from the Grand river, which forms a division line between the east and west sides of the city. During the past twelve years several investigations and recommendations have been made relative to supplying the city with a water safe for drinking and suitable for laundry purposes. However, no action was taken until three years ago, when Messrs. Hering & Fuller advised the construction of the now completed plant, this being a gravity mechanical filter plant, with a normal capacity of 20,000,000 gallons daily, including provision for softening the water, together with reaction, coagulating and clear-water basins.

### Operation of Plant

The general operation of the plant is as follows: Raw water from the river enters the intake chamber about 500 feet from the pumping station, flows by gravity to the low-lift centrifugal pumps, and is then forced to the stilling chamber, that forms a part of the headhouse basement. From here it enters the grit chamber, where heavy suspended matter is settled out. After passing thru the grit chamber it enters the mixing chamber, where chemicals are usually applied, and the water is kept in rapid motion until the proper reactions have taken place. From here it is admitted into the coagulating basins, where most of the impurities are precipitated and the water is prepared for filtration. From coagulating basins it passes into and thru the sand filters, and from them into the clear water basin. From this basin it is led thru a concrete conduit to the high-lift pumping station, 2,700 feet away, being



FILTRATION PLANT, *Grand Rapids, Michigan. Filter buildings and wash water tower under construction.*

sterilized by hypochlorite at the entrance to the conduit, if this should be thought desirable.

### Pumping Station

The pumping station is a building 18 by 44 feet, located at the west side of the plant. The main entrance to the plant has been located at this point, and an east view may be considered the face of the buildings.

There are five raw water pumps, two wash water pumps and one sump pump, all centrifugal, single suction, vertical shaft type. These are all located in a pit or basement of the station, whose floor is, during a greater part of the year, below extreme low water. The raw water pumps, being thus located, are always primed. Three of these latter pumps have a capacity of 8,000,000 gallons per day each, and two a capacity of 4,000,000 gallons per day each, all against a 30-foot head. One of the 4,000,000-gallon pumps is so arranged that it can draw water directly from the pump room, and thus acts as a sump pump in case the pit should become flooded. All raw water pumps can be started automatically when the water in the stilling chamber falls below a fixed elevation and stop when it has been raised to another fixed elevation. They may also be controlled by hand. The two wash-water pumps, each with a capacity of 1,000 gallons per minute against a 52-foot head, draw from the clear water basin and discharge into the tank of the wash water tower. This tank is 40 feet 6 inches inside diameter and 11 feet 6 inches deep, containing over 100,000 gallons. The bottom of the tank is about 20 feet higher than the surface of the sand filters. A 20-inch cast iron pipe serves as both discharge from the pumps and outlet to the filters.

Ordinary seepage from the pipe gallery and pump room floors is handled by a small automatic sump pump of 180 gallons per minute capacity.

All pumps are operated by motors located on the ground floor, 17 feet above the basement floor. Alternating current of 2,300 volts is supplied from the municipal pumping and lighting plant a few blocks away. At the filtration plant this pressure is reduced to 440 volts and supplied to the motors.

CLEAR WATER BASIN, *under ground. Grand Rapids, Mich., filtration plant.*

The machinery contract for the pumping plant was let to the Fort Wayne Electric Works. The pumps used are those of the Buffalo Steam Pump Company.

Above the motor room are located the office of the chief chemist and the laboratories. Complete equipment for high-class water analyses has been placed by the city within these laboratories.

### Pipe and Operating Galleries

The pipe gallery is 18 feet wide, 125 feet long, and 17 feet high. This extreme width and height makes it possible to maintain a concrete walk through the center of the gallery above the 36-inch raw water force main and the 30-inch drain, and still leave head room below the 42-inch influent pipe, the 20-inch wash water pipe and the 6-inch pressure line, all of which are suspended from the roof of the pipe gallery, which is also the floor of the operating room. All other piping is arranged along both sides and roof of the gallery, and all is readily accessible except the raw water line, which is buried below the floor of the pipe gallery. All filter valves are operated hydraulically at about 65 pounds pressure.

In the operating gallery are filter operating tables of gray Tennessee marble, on each of which are mounted handles and indicating devices for operating the hydraulic valves, a faucet and bowl for sample water, a recording loss-of-head gage, and two gages registering the pressure in the wash water tower and the position of the orifice on the effluent line

to the clear water basin. Two recording gages register the water level in the two compartments of the clear water basin, and are located near the office end of the building. Filter rate controllers of the Earle type are installed, and, in addition to maintaining a constant rate of flow, are constructed in such a way that if the water level in the clear water basin is lowered, the rate of filtration will increase up to a predetermined maximum, when all filters will discharge at this maximum rate until such a time as the water begins to rise in the basin, when the filters will gradually slow down until the basin is full, when they will shut down entirely. The maximum can be set at any desired point between 1,000,000 and 2,500,000 gallons per twenty-four hours.

### Filters

There are ten filters, each with a normal capacity of 2,000,000 gallons per day, five on each side of the pipe gallery and operating floor. The filters are supported on the groined circles which form the roof of the clear water basin. Each filter is approximately 25 by 36 feet, outside measurement, and 9 feet deep, and is divided into halves by a center gutter 2 feet wide in the clear. Each contains twelve lateral gutters, six on each side of the center gutter and spaced 6 feet between centers. These gutters, like all the construction, are of reinforced concrete. The lateral gutters are set with their top edges 5 feet 6 inches above the bottom of the filter box, and their bottoms have a slope of 6 inches in the 10 feet 3 inches between the side wall and the center gutter. In washing, all water is carried off thru the lateral gutters, none being allowed to flow directly into the center gutter. The total sand area of each filter is about 734 square feet. It was specified that the sand should have an effective size of not less than .35 nor more than .44 of a millimeter, and a uniformity coefficient of not more than 1.65. The entire bottom of each filter is covered with a system of strainers. These consist of a series of concrete ridge blocks resting upon the floor crosswise of the filter. Each block is 9 inches wide at the base, and there is a space 3 inches wide in the clear between successive blocks, which serves as a water passage. The blocks have vertical sides for 5 inches above the floor, at which point there is a shelf ⅜-inch wide for the support of the strainer plates, above which the blocks continue to a further height of 8 inches in the form of a truncated wedge 2½ inches wide at the top. On the narrow shelf rests a strainer plate, continuous from end to end of the blocks and covering the top of the water passage, or 3-inch space between the blocks. These strainer plates are of bronze, No. 16 B. w. g., with 1/16-inch holes drilled about 1 inch apart over the most of their area. The space above the strainer plate and between the upper portions of the ridge blocks is filled with gravel graded from coarse at the bottom to fine at the top. Resting on top of the gravel and of the ridge blocks, and anchored to the latter, is brass wire screen cloth, No. 20 B. w. g., 10 meshes per inch. Above this screen cloth is placed 2½ feet of filter sand.

In operation the water passes down thru the filter sand, then thru the screen and the gravel, thru the strainer plates to the water passages between the ridge blocks, which passages conduct it to a center collector, thru which it passes into the pipe system underneath the filters. In washing the filters the direction of the flow is reversed, filtered water being passed upward thru the strainer plates, gravel and sand, but at a much higher rate, approximately 2 cubic feet per minute per square foot of sand area. No provision has been made for the use of air in washing.

### Stilling Chamber

The stilling chamber in the basement of the headhouse acts merely as a receiving chamber for the raw water pumps and as a center of distribution, the openings into the grit and mixing chamber and double conduits of the center passage being by 36 and 42-inch sluice gates. The grit chamber is 153 feet long and 21 feet wide, divided by a baffle running longitudinally and composed of a 4-inch concrete wall connecting 12-inch square roof piers, spaced 12 feet apart, the end of the baffle coming within 9 feet of the end wall. The capacity is such that when

operating at 20,000,000 gallons a day the water will remain 26½ minutes in the grit chamber. The mixing chamber is 44 feet wide by 160 feet long, and holds about a 53-minute supply at the normal capacity of the plant. The entire chamber is furnished with cross baffles spaced 3 feet apart between centers, constructed of ⅞-inch tongue and groove flooring, stiffened by three 2 by 4 timber braces at intervals of 6 feet, each baffle extending to within 4 feet of the side wall. The water may thus be compelled to take a circuitous course over 2,000 feet in length, but it can be drawn from the mixing chamber into the center passage at four different points, as will be stated later, thus permitting of varying the time for chemical reaction as the condition of the water changes.

### Coagulating Basins

The two coagulating basins are each 118 feet 9 inches long, and one is 118 feet 6 inches wide and the other 88 feet 6 inches, the capacities of the two being 1,450,000 gallons and 1,135,000 gallons, respectively. They may be operated singly, in parallel or in series. These basins are provided with "around-the-end" baffles, spaced 15 feet apart and composed of 4-inch concrete walls. The water is withdrawn from each basin over a skimming weir made of stop planks, thus enabling the operator to take the settled water from various depths below the surface. As an aid in clearing the basins, and as a possible temporary raw water supply to the coagulating basins for corrective purposes, a 16-inch cast iron pipe receiving water from the stilling chamber is run to these basins, also to grit and mixing chamber, and provided with 12-inch outlets controlled by gate valves. This will provide raw water for flushing the basins when cleaning them. A 4-inch cast iron pressure main has been laid along the back end of the basins, and 2½-inch hose gates attached provide filtered water for cleaning.

### Center Passage

Within the two walls separating the two coagulating basins from the mixing chamber is one of the features of this plant, called the "center passage," consisting of two conduits placed one above the other, the upper one being 10 feet high, 6 feet 4 inches wide at the top and about 5 feet 6 inches at the bottom, the lower one being 4 feet 4 inches high, about 5 feet 6 inches wide at the top and 5 feet at the bottom. Water from the mixing chamber enters the lower conduit thru one of the four sluice gates (depending upon the amount of mixing desired), and from this conduit is discharged into one or both of the coagulating basins. The effluent from the coagulating basins is taken into the upper conduit and by it conveyed to the filters. By-passes with sluice gates are so arranged that water can be taken directly from the headhouse into the mixing chamber, or directly into the coagulating basins, or all the basins can be by-passed and raw water turned directly into the filters. Also, water can be passed directly from the mixing chamber onto the filters or raw water direct to the city mains. In fact, any combination of grit chamber, mixing chamber, coagulating basins and filters can be used by means of this double conduit.

A 12-inch drain pipe is laid under the center passage, from which short branches controlled by sluice gates open into each compartment of the coagulating basins, mixing chamber and grit chamber, the bottoms of which all slope to the sluice gates. This is to provide for removing the sludge and also for emptying the basins. This drain discharges the sludge into the pipe which receives the filter wash water, and which leads into the river several hundred feet below the intake.

From the controllers the filtered water passes directly into the clear water basin, which is divided into two compartments by the pipe gallery. The north basin, occupying the space under the north half of the filters, holds about 384,500 gallons; the south compartment holds about 2,659,500 gallons, and is provided with a baffle wall, which, like most of the other baffles, is a 4-inch concrete wall, extending to within 30 feet of the south wall of the basin, the object of this being to insure circulation of the contained water.

FILTER BUILDING *interior, Grand Rapids, Michigan, water purification plant.*

### Chemicals

The chemicals used are lime, alum and hypochlorite. A siding will some day be built from the Grand Trunk Railroad and pass close to the front of the headhouse, so that the chemicals, coal and other materials can be unloaded directly from the cars. In unloading, the chemicals will be spouted into an elevator boot in the basement of a tower which forms a portion of the headhouse. The elevator, an ordinary bucket elevator, will lift them 90 feet to the top of the tower, where they will discharge into a hopper and from there be spouted into concrete storage bins. A small gyratory crusher is provided for crushing lime, and an electric freight elevator for various uses. There are eight storage bins of reinforced concrete, each 8 feet 6 inches square and 19 feet deep, their bottoms being inclined 45 degrees and terminating in cast iron spouts provided with undercut gates. The storage capacity of these bins is about twenty carloads. About ten tons of lime is used daily.

The chemicals are discharged thru the spouts just referred to into circular steel buckets, each holding about 500 pounds, and suspended from ball-bearing trolleys running on a single I-beam overhead track, this track passing under all the bins and over all the mixing apparatus. Each bucket is suspended from a scale with an indicating dial, so that each charge can be weighed.

There are three steel lime solution tanks, each 12 feet 5 inches in diameter by 13 feet 6 inches deep. For slaking the lime, ordinary concrete mixers were adopted, with the idea of overcoming some of the difficulties encountered in stirring large quantities of lime with revolving blades. After slaking, the lime is carried by steel troughs to each of the solution tanks. There are three alum solution tanks of reinforced concrete, and two alum dissolving tanks. On the floor of each of the latter is a pipe grid composed of 1-inch pipes spaced 6 inches apart, perforated on the under side.

There are three covered hypochlorite solution tanks, the center one of which contains a concentrated solution, which solution can be drawn into either of the other two and there diluted to any required strength. The hypochlorite dissolving tank has a false bottom of cast

iron grate bars and spiked shaft placed just above, and so arranged that it may be revolved by hand. The hypochlorite is shoveled directly from the floor to the tank.

For agitating the chemical solutions each of the tanks is equipped with a two-bladed propeller mounted in a vertical funnel-shaped casting, the bottom edge of which is supported 3 inches above the floor of the tank. The propeller is operated by an electric motor. The propeller draws a current of the liquid in thru the top of the funnel-shaped casting and discharges it with considerable force at the bottom across the floor line. The liquid then rises upward along the walls of the tank, across the surface of the tank to the center and down again thru the propeller.

The chemicals flow by gravity from the solution tanks to the feed controllers on the floor beneath, duplicate lines being provided for each solution. Iron pipe is used for the lime and lead pipe for the alum and hypochlorite solutions. It is so arranged that solutions can be applied at different points at short intervals along the center passage and at the entrance to the filters, thus enabling the operator to vary the time allowed for chemical reaction. For each of the solutions duplicate controllers of the Earle type are provided. They are operated in conjunction with a Venturi meter (on the raw water line) and a waste chemical controller, which so regulates the depth of the solution that the head above the discharging orifice varies in direct proportion to the amount of water passing into the reservoirs. Once the orifice has been properly set, the controller automatically proportions the chemicals exactly to the quantity of water passing thru the plant.

In the basement of the headhouse are located the lime-crushing machinery, freight elevator machinery and the steam heating plant, with necessary storage bins for fuel. At the top of the tower are located the bucket elevator machinery and spouting devices.

### Buildings

The pump pit, filters and basement of the headhouse are entirely covered with a building, which forms the upper portions of the pumping station, headhouse and wash water tower, and a successful effort was made to make this architecturally pleasing. The exterior walls are of hard-burned, dark red paving brick, all laid in Flemish bond, except that certain portions of the buildings have stretchers of bright colored brick and headers of dark color. All sloping roofs are covered with dark green glazed tile, supported on cinder concrete slabs. For trimming, dark green terra cotta was used. All buildings are lighted by electricity and heated by steam. Practically the entire plant, except the brick facing of the walls of the building, is of concrete, either plain or reinforced. Portland cement, sand with no particles greater than ¼ inch in diameter, and gravel from ¼ inch to 1½ inches in diameter were used in this work. For the greater part of the work these were mixed in the proportion of one volume of cement to six volumes of sand and gravel, the sand and gravel being so graded as to secure a maximum density. Wooden forms were used throughout, except that Blaw forms were used in construction of the conduits.

The roofs of the clear water basins are groined arches, those of the grit and mixing chambers are reinforced flat slabs supported by concrete beams, and the coagulating basins have elliptical groined roofs. The floors of the coagulating basins are inverted parabolic groined arches resting upon a sub-floor of concrete, which is 3 inches thick on firm earth and 6 inches with reinforcement on quicksand. Floors of all other basins are flat, built either of plain or reinforced concrete. In several instances it was considered best to place 6 inches of gravel under the concrete to act as a drain. Steel plates ⅜ inch thick and 12 inches wide were employed in all expansion joints or to join adjacent sections where the structure was too large to be constructed as a monolith. The joints between sections of groined arches were also made in this way. Corrugated and Kahn bars were used for reinforcement, diameters ranging from 3/16 inch to 1 inch being employed. The concrete was

made wet and forms were left in place at least ten days, and generally two to three weeks, especially beneath the arches.

All corners of structures were built in monolithic sections extending at least 6 feet on each side of the corner. The 4-inch baffle walls were reinforced and built in monolithic sections, bonded into columns or walls. All basins, channels and chambers were tested for water tightness, but very few imperfections were found.

### Concrete Construction Features

One of the most interesting features of the construction work was the concrete distribution system. The concrete was mixed in a Ransome mixer, which turned out about 125 cubic yards of material a day. The mixer discharged it directly into a bucket which held one batch of 12 cubic feet. This bucket was elevated by cable, attached to the drum of a 125-h.p. steam engine, to the top, or to an intermediate hopper of a tower 157 feet high, this tower carrying a horizontal boom of trussed timber construction. A 7-inch galvanized iron pipe carried the concrete from the top of this tower to a secondary tower, which, in turn, carried two booms, and similar pipes carrying the concrete to the end of each of these booms. At the end of each boom the concrete flowed into another pipe, which was free to move in any direction, its upper end being supported by the end of the boom. This made it possible to reach any part of the plant with the outlet ends of these last mentioned pipes. The concrete was made quite wet, and, after being once discharged from the first bucket, flowed thru the pipes directly into the forms without further handling.

The contractor had a complete plant on the ground for making forms and for other carpenter work required, this including a band saw, rip saw, planer, etc., operated by electric power, together with benches and a complete carpenter's outfit, all inclosed in a substantial frame building.

The construction was divided into four contracts, one for the clear water conduit, intake and drain, which was awarded to J. P. Rusche, of Grand Rapids, Mich., for $51,518.44. The second contract was for furnishing and installing all pumping machinery, and was awarded to the Fort Wayne Electric Works for $12,425, the Buffalo Steam Pump Company furnishing the pumps. The third contract was for the various basins and substructures, including all excavation and grading. This was awarded for $123,842 to A. H. Prange, of Grand Rapids, who, in turn, sublet all concrete work to Gentz Bros., of Grand Rapids. The fourth contract for the construction of the buildings, wash water tower, filters, piping and all the special devices, was awarded for $159,882 to the Roberts Filter Manufacturing Company, of Philadelphia, who sublet all building and concrete work to Gentz Bros. All general plans were prepared by Hering & Fuller, of New York City, Geo. W. Fuller taking charge of the work after the dissolution of this firm. The construction was under the supervision of Samuel A. Freshney, general manager of the board of public works, R. E. Harrison being the resident engineer in charge.

## MUNICIPAL STREET RAILWAY SUCCESS

The Finance Committee of the San Francisco Board of Supervisors has the following to say regarding the operation of the Geary Street Municipal Railway, which began operations with the year 1913:

"In four months' operation this railway has paid a handsome profit, notwithstanding that it is burdened with interest charge on $2,000,000 of bonds, only half the proceeds of which are in actual use. It now appears that the road will more than pay its interest and redemption; but, to be on the safe side, the Committee has placed i nthe Budget $20,000 for interest on the bonds of this utility. It is not expected that this $20,000 will be drawn, and it is expected that, before the end of the fiscal year, with the road in full operation from the Ferry to the Beach, municipal operation of street railways in San Francisco will be a demonstrated success."

# WHY THE MUNICIPAL OFFICE NEEDS MODERN SYSTEM

*By E. H. Gilman, Office Specialist, Rochester, N. Y.*

NOWADAYS, when a man walks into the city treasurer's office to pay his taxes, he proceeds immediately to a table over which hangs a sign bearing the number of the ward in which he lives, and gives his street, lot number and name to the man in charge. Without the loss of a moment's time his receipted tax bill is taken from a tray on the table. The money is paid and the transaction closed in two or three minutes.

Contrast the quickness and efficiency of this method with the ordinary procedure, whereby a long line of people move patiently up to the desk while huge books are removed from shelves, bills made out and handed out to each one in turn, while the rest wait and listen to the scratching of slow-moving pens.

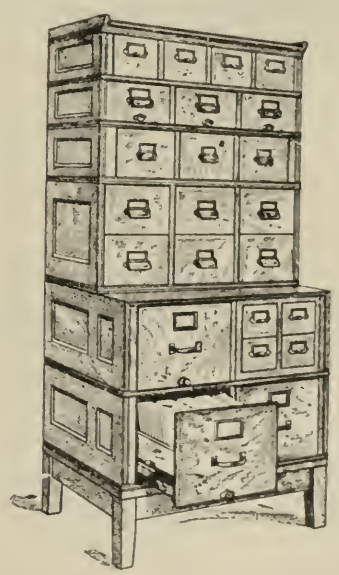
This is only one instance of the application of modern ideas of filing to city departments. The filing system goes

UPRIGHT SECTIONS. *These expand sideways. Each drawer holds 5,000 papers. Great capacity in small floor space.*

deeper than the mere selection of trays and indexes in which to file the tax bills. If some one had not conceived the idea of making out all tax bills in advance of payment date, the application of the system would have been impossible. The filing system must strike at the root of inefficiency and change methods as well as equipment.

### Filing Devices in City Offices

The value of filing devices in municipal offices is only exceeded by the value of knowing how to use them to the best advantage. If you are keeping your papers folded up in document files you are availing yourself of a filing method, but it may not be the best method for your purpose. It might save you a lot of time and trouble if you filed your papers flat, instead of folded, and kept them in vertical drawers. To have a filing cabinet is not to have a filing system, and even



SECTIONAL FILING CABINETS *adapt themselves to records or papers of any size.*

to have the latter is not a guarantee of filing efficiency. You must have the best system for your purpose.

To illustrate the growing use of vertical drawers in place of document files, we might cite a recent installation of equipment in the new city hall of a town in the Northwest, where, out of a total of ten departments, only two put in any document drawers whatsoever. On the

Cuts are shown by courtesy of Yawman & Erbe Co.

other hand, no less than 143 vertical drawers were installed in nine of the departments.

The advantages of vertical filing for letters and many other kinds of papers are almost too numerous to mention. Papers are placed flat in folders which are filed in deep drawers behind "sign post" guides. All the papers relating to one person or subject are kept in the same folder. Any scheme of indexing can be used—alphabetical, numerical, geographical or subject. Expansion at any point can be taken care of without the slightest difficulty. The drawers moving on frictionless rollers slide open and close at the slightest touch. The capacity of a single vertical drawer is 5,000 papers, and this makes for the greatest economy of space possible in any method.

### Assessor

If we pass to the subject of card records, we find that this form of record-keeping is taking the place of book records in all departments of municipal government. Here, for instance, is a card used in the assessor's office. (Exhibit 1.) Each piece of property is recorded on one of these cards, which gives location, owner's name, details of street improvements, and amount of assessment on vacant land, improved property, etc. The card is of a convenient standard size, 6 by 4 inches, and is filed in a cabinet indexed by streets. The file is always kept alive and up-to-date, old cards being removed and new ones inserted whenever necessary. The system is compact, inexpensive and easy to maintain.

### Street Department

Exhibit 2 shows a set of cards used by a street department as an index to all records which pertain to their work.

6

AVE. No.

OWNER

STREET IMPROVEMENTS 1911

PAVEMENT SEWER WATER GAS ASSESSMENT

| YEAR | VACANT LAND | IMPROVED PROPERTY | PERSONAL PROPERTY | CAUSE OF EXEMPTION | AMOUNT OF EXEMPTION | TOTAL ASSESSMENT |
|---|---|---|---|---|---|---|
| 1912 | | | | | | |
| 1913 | | | | | | |
| 1914 | | | | | | |
| 1915 | | | | | | |
| 1916 | | | | | | |
| 1917 | | | | | | |
| 1918 | | | | | | |
| 1919 | | | | | | |
| 1920 | | | | | | |
| 1921 | | | | | | |
| | | | | "Y AND E" 574923 5M. 3-11 | | |

EXHIBIT 1. *Record cards for assessor's office.*

Each card form is of a distinctive color, making reference easy. If you want to find what work has been done on a certain street you turn to the index guide bearing the name of the street and look over the canary colored forms headed "Work Card." Selecting the proper card, you obtain a reference to the dates and description of work done on this street.

*Exhibit 2.*

WORK CARD (Canary color)
Street Job
From To
Date Description Book No. Page

STREET NUMBERS (Straw color)
Old No. New No.
Street
Former name
Applicant Date

---

STREET PLANS (Salmon color)
Street From To
Plan made by No.
Alterations made by
Profile made by No.
Alterations made by
Curb Sidewalk Roadway
Date accepted

---

SEWER PLANS (White color)
Street From To
Remainder same as "Street Plans" card except one line,
Sewer Book No. Page No.

---

BUILDING LINES (Dark blue color)
Street
From To
Location Distance Map Adopted

---

PUBLIC SERVICE (Yellow color)
Street
From To
Name Description Location
Water main
Gas main
House sewer
Storm sewer
Elec. conduit

---

BENCH MARKS (Red color)
Street
From To
Description Elevation

---

MANHOLES (Brown color)
Street
From To
Location Description Elevation

---

STREET SPRINKLING (Light blue color)
Owner
Address
Location of Property Frontage
Book No. Page

### Purchases

The card system is also very well adapted for requisition and order systems. The rule must first be made that before you can make a purchase or get any work done, you must make a requisition on the man who has purchasing power and secure from him an order. Requisition forms similar to the one illustrated (Exhibit 3) may be made up in a card index size, 6x5 for instance, and padded in duplicate, alternating paper slips and cards. By using carbon paper you make every requisition in duplicate, sending the original to the commissioner and retaining the copy as your memorandum. The purchasing agent, in this instance the commissioner of public buildings, makes out his order in similar fashion. His duplicate he files in a card drawer behind a guide marked "Unfilled Orders.' When the goods have been delivered or the service rendered, the invoice or claim is O. K.'d, and the copy of the order filed away under the heading of "Filled Orders." You treat your requisition copy in a similar manner. Thus an excellent check is kept on all orders and requisitions.

A very valuable record for the comptroller or purchasing agent is a complete record of purchases, cross-indexed by name of vendor or claimant, and by article. The record may be kept with a minimum of work on two card forms similar to those shown in Exhibit 4, which in full are 8 inches wide by 5 inches high. One card is made out for every claimant who has furnished goods or service to the city. These cards are filed alphabetically and the comptroller can ascertain from them details of all purchases which he has made from any one party. The other card, used as a cross-index, is made out for every kind of article purchased. Spaces for entering the amount of the highest bid and the amount saved by placing the order with the lowest bidder, yield much valuable information to the purchasing agent when he is about to order an additional quantity of this particular article. These cards are filed alphabetically according to name of article, and as time goes on, will become a record of increasing value, enabling the purchasing agent to buy to the very best advantage.

*Exhibit 4.*

WHITE CARD:
Card No.
Article
Remarks
Column headings are:
Date
Order No.
Purchased from
Quantity
Description
Price Paid
Amount
Total
Highest Bid
Amount Saved

SALMON CARD:

Claimant

Column headings are:
- 190
- B
- Claim number
- Merchandise
  - Quantity
  - Quality
  - Price
- Department
- Amount

### Water Department

In touching upon the different departments of the municipality in which card records may be used to advantage, we cannot pass by the water department without brief mention of some of the card records which are used in this branch. The value of card records for the water board is especially great in view of the necessity for indexing one record according to location, another according to owner's name, and the third according to meter number, and so on, for adequate indexing is a prime factor in the efficiency of water department records. And indexing reaches its highest point in the card system.

To begin at the beginning, the property owner must first make application for water service, and the service must be installed by the department. In Exhibit 5, three forms are shown; the first, which is an application form bearing the signature of the property owner, being printed on the reverse side of the second card form. Turning the card over, the clerk fills in the heading showing location, name and address of owner, etc., and then copies this information on the other form, which is identical with the one mentioned, except that it bears no application on the reverse, is a trifle longer, and is perforated for a ring binder. This card is turned over to the construction foreman, who carries it in a ring binder to the scene of the work, and after the installation has been made turns it in at the office with full details of cost entered in the spaces provided.

The other card has, meanwhile, been kept in a temporary file. The costs are copied upon this card and thence entered in the ledger. The two cards are then filed away, one according to location, and the other according to name of property owner.

As soon as the service has been installed a permanent record must be made and kept in the water department in a so-called "property record." A card well adapted to this purpose is shown in illustration 6. In the wide space at the top is entered the street and number and owner's name. Below is kept a record of all fixtures installed. These cards are filed according to street and house number and furnish an index to the ledger.

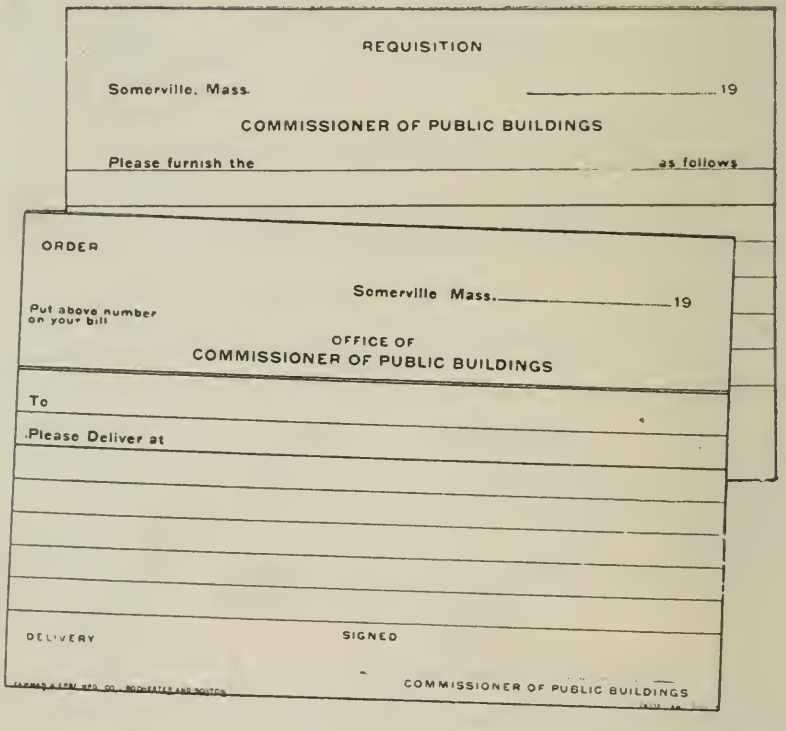



EXHIBIT 3. *Requisition and order cards for purchase of supplies.*

The card ledger is far ahead of any other for the use of the water board. It is generally necessary to use two forms of cards; one for the fixed rate, and the other for the metered houses. In illustration 7 are shown simple forms well adapted for the average department. Both kinds of cards may be filed together,

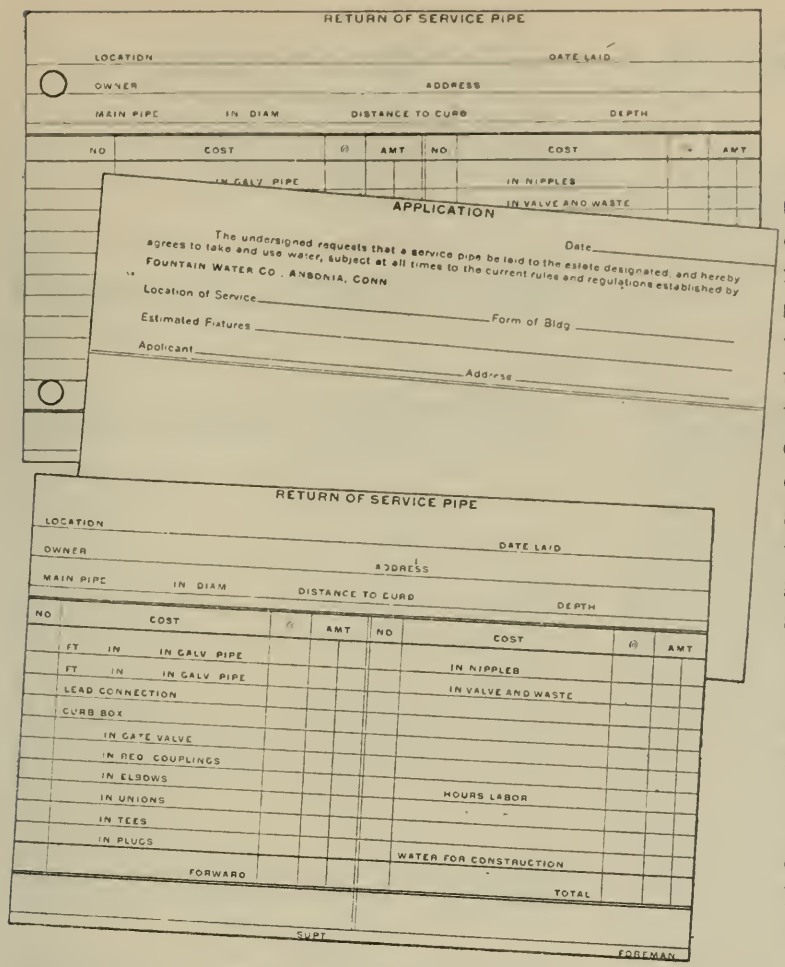



EXHIBIT 5. *Record of applications for water service, connections and service pipes.*

indexed either numerically or alphabetically. For these cards and also for the property index cards, ledger desks with their capacity for handling thousands of cards in a limited space, are widely used.

The use of cards is also extended to the work of the meter readers. A card per sample 8, perforated for use in a ring binder, is made out for every house in which the service is metered. The cards are kept on file in the office, arranged by routes. Every day the meter readers remove a bunch of the cards from the files and take them with them on their trips, returning them at night.

The use of cards is being extended to all departments of municipal governments. Scores of different uses can be described, but space permits of mention of only a few. From these few, however, some idea may be obtained of the adaptability of card records for a wide range of uses, and some notion may be gained of their time-saving and labor-saving possibilities.

### Filing Cases

Another matter that has received a considerable share of attention in municipal offices is the care of valuable maps, drawings, blue prints, and other large sized sheets, which are ordinarily rolled up and stored in pigeon holes, where they accumulate dust, or are kept in clumsy drawers, where it is almost impossible to get at them when they are wanted. In city engineer's offices, in water construction offices, in the offices of street and park commissioners, and many other departments, a large vertical file is now used. This is termed "The Mammoth Vertical File," and a good idea of it may be had from the illustration. Compact as is this file, occupying a floor

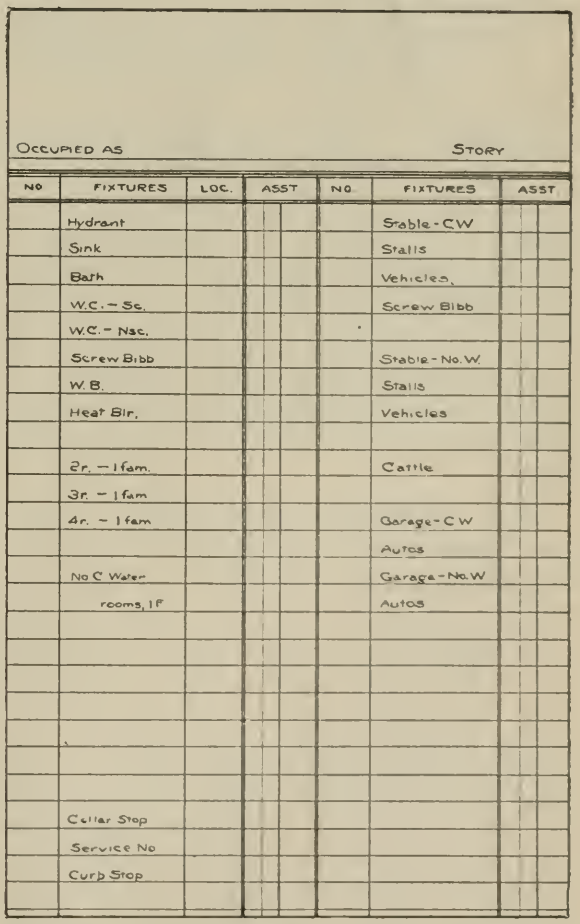



EXHIBIT 6. *Record of Fixtures and Services Used by Customer.*

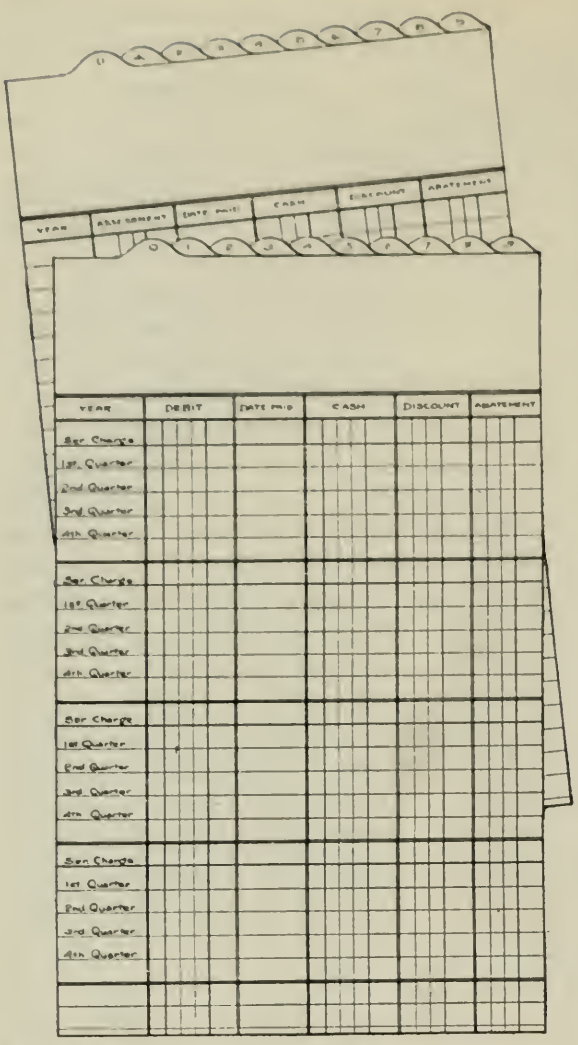



EXHIBIT 7. *Card ledger for accounts of water consumers.*

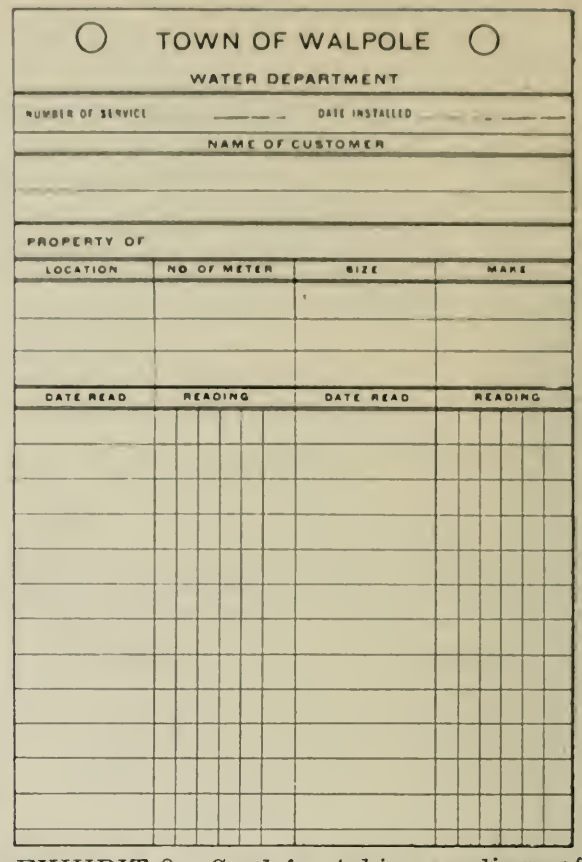



EXHIBIT 8. *Card for taking readings of water meters.*

space of less than four square feet, it nevertheless will take care of from 700 to 1,000 drawings or blue prints. They are kept flat in large pockets and so indexed as to be immediately available. A clever device makes it possible to use the front of the cabinet as a reference table.

Men prominent in municipal affairs are everywhere awakening to the advantages of up-to-date filing and card records, and to the necessity of installing adequate filing equipment. They are among the foremost in the efficiency movement which is sweeping over the country, and it is proper and fitting that we should look to the public offices for an example of modern system ideas.

The author would be glad to communicate with any who desire further or more detailed information regarding any of the records which have been touched upon in the foregoing. Samples of cards in actual use and covering a wide range of requirements will be gladly sent. The exchange of ideas on this subject would be mutually profitable and is a thing to be desired.

# TEST OF WATER DIVINING EXPERTS

The English *Sanitary Record and Municipal Engineering*, published in London, recently made a test of the ability of water diviners to locate bodies and streams of water with hazel twigs or other such supposed indicators. Six Englishmen and one German offered themselves for test. The committee of well-known engineers, scientists and municipal officials reported that what little sensitiveness to underground water may exist in some persons is not sufficiently definite and trustworthy to be of much practical value. Known bodies and streams underground were not definitely located if at all and other locations were erroneous.

# PASADENA MUNICIPAL LIGHTING PLANT

THERE has been so much controversy recently over the results of the operation of the Pasadena electric light plant, the statements made in the discussions of it have been so imperfect, so incorrect, and so garbled, and the omissions from the statements have been so numerous and so misleading that it seems worth while to gather together the information that has been published by those on both sides of the controversy into a story which will be as consistent as possible with itself and will show as nearly as possible why it differs, where it may, from any statements which may have been made.

Glenn Marston, in his "200 Municipal ownership failures," says the plant had only 1,700 customers as compared with 4,000 of a private company and that the plant charges the city rates for street lighting which are equivalent to $1.16 per capita per year as compared with 65 cents average in California cities. As usual, in the pamphlet referred to, the statements are out-of-date, incorrect, based on wrong assumptions and therefore misleading, apparently with intent, as will be seen from the facts. The plant is not yet six years old and had only 1,700 customers three or four years ago but had 4,333 meters in use on January 1, 1913, with the number increasing every month. Pasadena has many wealthy citizens, occupies a large area and pays more for its exceptionally good lighting in proportion to its population than less favored cities, altho it pays as low a rate per lamp per year as its neighboring cities and pays far less for ornamental lighting.

Before the municipal plant was started the city was served by what is now the Southern California Edison Company, which serves some twenty-five or thirty municipalities with a total population of 450,000 to 475,000, including Los Angeles, 320,000, and Pasadena, 32,000, and several of 10,000 to 18,000 population. It is stated that the company's commercial base rate was formerly 12½ cents per kw. hr., reduced from 15 cents when a municipal plant was threatened. The rates now in force in other cities than Pasadena are from 8 to 10 cents, excepting in Los Angeles, where the rate is 6½ cents. The rate paid the company by the city for arc lamps was $78 a year, moonlight schedule.

Whether the starting of the municipal lighting plant was a political measure or was a real protest against the rates charged and the poor service rendered, can not be definitely determined from a comparison of statements at hand, and really makes no difference in the result. Notwithstanding the power of the city to regulate rates within reasonable limits, the decision to build the plant was made and rates have been reduced.

The city pays the electric light plant $60 a month for arc street lights, moonlight schedule, or 23 per cent. less than it paid the Edison company. This is the same price that the company charges most of the other cities it serves, the $76 charge to Los Angeles for all night service being practically the same in proportion to candle power furnished. There is therefore no basis for Marston's statement that the Pasadena rate is the highest in the state.

### Rates Present and Past

The city charges for commercial incandescent lighting, 5 cents per kw. hr. for the first 100 and graduated lower prices down to 3 cents for all over 2,000 per month. Since February 1, the minimum monthly charge has been 60 cents for 3 kw. meters and 30 cents for each additional kw. of meter capacity. Gem or metallized lamps are furnished free if more than 50 watts capacity is in use, and agreement is made that when the number of consumers reaches 6,000 the minimum will be reduced to 50 cents.

Power rates are 4 cents for the first 100 kw. hrs. and graduate down to 1.2 cents for all over 3,000 used in a month. The minimum charge is $1 per month on meters of 1½ capacity and 75 cents for each additional kw. capacity.

These rates are certainly less than the 15 or 12½-cent base rates prevalent under company service six or seven years ago, and less than the reduced 8 to 10-cent rates the company now charges all the smaller cities it serves, and appreciably less than the 6½ to 2.3-cent rates charged in Los Angeles by the same company.

The saving to light and power users in Pasadena is evident.

The municipal plant was constructed first with capacity for street lighting and some commercial lighting in the business district, the first bond issue in 1906 being $125,000. Later general commercial lighting was decided upon and the plant has been enlarged as detailed below, to take care of the rapidly increasing load on account of the growth of the city and of the business of the plant.

The city's plant first charged 9 cents as a base rate as compared with the company's 12½ cents with 10 per cent. discount for cash. The company dropped its rate below that of the city's plant and the city, as its operation of the plant developed the possibility of doing so, has reduced its rates to those given above, the latest reductions being in the minimum rates and granting of free lamp renewals.

The company has dropped its rate to 4 cents for the first 100 kw. hrs., graduated down to 2¾ cents for all over 2,000 kw. hrs., with free lamp renewals and no minimum. The city does not attempt to meet these rates, believing that it cannot do so without running at a loss, whereas it is now able to make a substantial addition to its surplus each year after paying interest and bonds as they come due and making allowance for depreciation according to a carefully devised schedule for all the various parts of the plant.

Because the city does not meet the company's price the company claims that the city cannot compete with it and induces the inference that the city's plant is losing customers, whereas, it has gained customers every month but one since it began business and gained 6.2 per cent. in the number in the last full fiscal year. The city believes that the company is losing money on its Pasadena business at its present rates and has tried every method except one of forcing an increase. An appeal to the a maximum of 8 cents, which took effect January 1, 1913. The company agreed to reduce rates in cities to 8 cents also. The city pressed this suit in the belief that if the company was obliged to reduce its rates in all the territory it serves under the methods of the State Railroad Commission, it would not have surplus enough from operations in those cities to make up the deficit in its Pasadena business and so would be obliged to raise its rates to a practical equality with those which the city has found reasonable.

### Rate Regulation

The city has now taken up the matter with the other cities served by the company, proposing that each one fix the lighting rates by ordinance, as each one has the legal right to do, taking Pasadena's experience as a guide in the investigation to determine what the rates should be. In this way they think the rates would probably be reduced so that the surplus to meet the company's losses in Pasadena would be reduced if not wiped out. The company considered itself justified in making the combinations and extensions which have resulted in its present extended business, but is evidently not pleased when the cities it serves are proposing to make a similar combination. They are easier to handle singly.

Pasadena passed one ordinance which may produce some of the effect desired. This ordinance fixes the rates for electric current for power at 6 cents for the first 100 kw. hrs., graduated down to 1.2 cents for all over 3,000 kw. hrs. used per month, being the same as the Los Angeles rates, with the proviso that if lower rates are charged the plant using them must file certified statements of accounts showing that the plant can make 4 per cent. on its investment at these lower

ORNAMENTAL STREET LIGHTING, *Orange Grove Avenue, Pasadena, California.*

rates. The city plant has complied with this ordinance but the company has not, thus giving some color to the claim that the city's power to regulate rates is theoretical rather than practical, in the absence of the power to supply the service independently of the company.

The company very pertinently asks why, under its established power of rate regulation, the city does not fix the rates at which electric current shall be sold. The city attorney replies in an unofficial communication, substantially that, since such an ordinance would increase the rates now charged by the company, it would give an argument for political use which would be stronger than the city administration is willing to put into the company's hands. The ordinance fixing power rates is such an ordinance as far as it goes, but, since Pasadena has very few power users and they are in general loyal to the municipal plant, it does not influence any very large number of votes.

To the outside observer, an ordinance definitely fixing rates for lighting based, perhaps, on those of Los Angeles, like the power ordinance above described, would seem to be the proper procedure. Unfair misrepresentation could not go farther under such an ordinance than it does at present, altho it would directly touch the pocketbooks of more voters. But the citizens, especially those resident long enough to know the history of the controversy, are loyal to the municipal plant, as is manifested by the continual increase in connected customers in the face of a company rate 20 per cent. lower than the city rate, so that in some five years of operation the city plant has gained a patronage equal to that of the company. These loyal supporters deserve consideration and it would seem that the danger of loss of votes among them from this time on would be nearly as great as that of loss of votes among the customers of the company's plant. That the voters have been in favor of the municipal plant is shown by the votes for bond issues for its construction, the first bond issue for the street lighting plant receiving a bare majority, while later issues for its enlargement to extend the commercial service over the entire city have had very large majorities.

If the city administration will now force the company to justify its power rates or raise them to the schedule fixed by the ordinance, it will either have the ammunition for an extension of its campaign by the passage of a similar ordinance covering lighting rates or it will have a demonstration that the company can supply electric current cheaper than the city can. Then an ordinance fixing the company's schedule as the legal rate card would secure the citizens their light at low figures.

The questions then to be solved would be, first, whether the city plant could afford to operate on the lower schedule, and second, whether, if it could not, the city could afford to pay the deficits in order to keep the plant in operation as a check on undue influences tending to amendments of the ordinance to increase the rates again.

The company contends that the plant is now operating at the expense of the taxpayers and it or someone in its behalf is guilty of some very flagrant misrepresentations of fact to give color to this claim. The justification of the existence of the plant lies in its financial success so that it is essential that the exact facts be known to the voters in case the agitation against the municipal plant brings the question before them for decision in any form.

MUNICIPAL ENGINEERING is not an advocate of municipal ownership, neither is it opposed to it if properly administered, and is only interested in presenting the facts. In the absence of an expert investigation of the situation by an unbiased state or other commission, the following brief analysis of the financial operation of the plant is presented in as impartial a manner as possible, in the hope that it will show the validity of any objections which are well based and the falsity of such as are evidently misrepresentations. The figures in the annual reports of the plant are used as there has been no suggestion that they are incorrect.

### Capitalization

The plant was built out of the following funds:

| | |
|---|---|
| Taxes, to pay bonds and interest | $123,026.06 |
| Borrowed from general fund but carried as an indebtedness of the plant | 40,000.00 |
| Bond issues, being $325,000, less $35,000 included in "Taxes" above | 290,000.00 |
| Used from depreciation reserve | 78,933.73 |
| Used from surplus account | 26,482.38 |
| Total of plant account | $445,416.11 |
| Total cost of plant | $558,442.17 |

The total cost of plant is given on p. 12, of the report for 1912 as $558,331.97. The company's statement is $35,000 higher than this because it has counted the bonds paid, twice. Deducting the depreciation above, the present value of the plant, July 1, 1912, was $479,508.44. This is very nearly that given on p. 12 of the report when the inventory of construction material on hand and not yet made a part of the plant is deducted.

Interest should be computed on this amount, rather than on the bonded indebtedness only, and this has apparently been done in the table of method of financing the plant on p. 1 of the report, the total difference between allowance and actual payments being $41,757.03. The interest allowance in 1912-13 would be $19,100 as compared with $11,825 due.

It is evident that the $163,026.06 from city funds should be considered as an indebtedness of the plant, as $40,000 of it evidently is, and that, if the plant is to be considered as entirely self-supporting, this amount should be repaid to the city with interest. On the other hand, the voters of the city, as represented in the city government, may consider that the plant is so valuable to the city and to its citizens that they are willing to make this contribution to its construction out of the general funds of the city. The city officials justify it by the estimate that, by the difference between the current 10-cent rate in other cities served by the company and the 4 and 5-cent rates in Pasadena charged by the company and the city respectively, the users of light and power in the city saved $200,000 in the fiscal year 1911-12, less amounts in previous years and greater amounts probable in coming years because of increase in patronage. The fact that the saving in one year more than covers the whole contribution from city funds, overshadows any question as to the fairness of producing a saving for light consumers at the expense of the taxpayers at large, whether users of light or not, especially in a city of the exceptional character of Pasadena. The city can afford to pay the whole bond issue and interest on it if this showing is even approximately correct.

### Saving to Consumers

The saving to light consumers is estimated from the charges for commercial light and power in the municipal plant for a year at the present rates, $81,389.56 in 1911-12, adding thereto the difference between these rates and those prevalent elsewhere under the company, the base rate being double and minima still larger, thus showing a saving to customers of the municipal plant approximating $100,000. The company's customers, whose present rates are 20 per cent. less, have saved a still greater amount, assuming that it has an equal number of customers, so that the estimate of $200,000 saving to current users is exaggerated but little, if any.

### Depreciation Allowances

The company claims that the depreciation allowance should be $12,145.89 greater but gives no reason. The city computes depreciation on a detailed schedule with such items as station equipment, 4 per cent.; overhead construction in six items, running from 2 to 6.4 per cent.; transformers and meters, 4 per cent. each; street fixtures, 5 and 8 1-3 per cent.; buildings, 5 per cent.; and three "personal property" items, 10 and 20 per cent. The average percentage of depreciation in 1911-12 was very nearly 4 per cent. of the valuation before deduction. There is room for difference of opinion, but no method of computation is offered by the company as justification for its claim for adding about 15 per cent. to that so carefully computed by the city.

No reason is given for additions to repair account, disconnections, operating

expenses, insurance, bad debts, injuries and damages, amounting to $25,720.56, altho they are stated to the cents. Possibly they are computed on the company's experience, or on an average of several years or several plants. Why such assumptions should be made rather than to use the exact figures it is hard to see. Such bookkeeping would effectually conceal the results of operation of the plant and the effects of efficient and economical service, and still these figures are used in an attempt to demonstrate a deficit in operation which the facts do not show. The city plant is carrying a surplus to take care of variations in such accounts, which amounted to $18,191.07 on January 1, notwithstanding a special draft of $9,000 upon it for damages on account of an accident. Criticism of the amount of surplus or working capital would be admissible, even if not demonstrated to be correct, but the additions proposed are without theoretical basis as well as being untrue.

An allowance of $804 for rent of office should be made as a credit to the city as the plant pays no rent for its office in the city hall annex.

Ordinarily an allowance for taxes of something like the $4,939.40 claimed by the company as reasonable would be made. This is about one per cent. of the present value of the plant. However, the state is the loser in California, as the taxes on the operative property of corporations of this sort go to the state and the city would actually receive not more than 10 per cent. of the proposed charge for taxes. Whatever this amount may be should be credited to the city and charged to the plant.

An overcharge of $11,011.66 on street lighting is claimed by the company's figures. No reason for this claim is given but there is a statement somewhere that the cost of street lighting per capita of population is higher than in other cities. Wealthy cities with broad streets and large lots are often willing to pay for even more light than is usual, but the same amount of light costs much more per capita, on account of the less density of population. Cost per capita of street lighting, bears little relation to economy in plant management or cost of electric current in comparison with other factors governing the method of measurement.

The fact is that the Pasadena plant charges the same for arc lights as other cities in the same district, and less for ornamental lighting, the charge for the latter being 2.676 cents per kw. hr., while Los Angeles pays the company 4 cents and other southern California cities pay 4 to 7 cents per kw. hr.

Again the statement is made that the average rate charged for commercial light and power is higher in the Pasadena municipal plant than in Los Angeles. This may be true and still the Pasadena rates be the lowest and the saving to Pasadena consumers large. The suppressed fact that 72 per cent. of the current used in Pasadena is for commercial lighting and that 76 per cent. of the Los Angeles current is used for power explains the seeming paradox, for much of the Pasadena current is paid for at 4 and 5 cents for light, while much of the Los Angeles current is paid for at 2 cents or less for power. The true meaning of such a statement being known its lack of application to the case is evident.

The city of Pasadena employed William Dolge, a certified public accountant from San Francisco, to make an audit of the books of the electric light and water plants of the city. The following figures are taken from his balance sheet as of March 29, 1913, and bring the information concerning the financial condition of the plant down to date:

The capital account shows the total property account as given in a detailed schedule, to be $580,745.23, from which depreciation according to a detailed schedule amounting to $95,679.32 is deducted, leaving the total assets, $485,-065.91.

Liabilities include bonds, $325,000, original issue, less $38,750 paid,

| | |
|---|---|
| Leaving unpaid | $286,250.00 |
| Premiums on bonds sold was | 3,836.43 |
| Contributions from city taxes were | 175,222.30 |
| A total of | $465,308.73 |
| Leaving a credit balance of profits in operation invested in the plant of | $ 19,757.18 |

The contributions from city taxes are thus carried as a liability of the plant. The items making up this total are as follows:

| | |
|---|---|
| Taxes of 1906 | $ 52,332.35 |
| Balance of 1911 lighting appropriation | 2,299.95 |
| Bond interest to June 30, 1912. | 41,518.75 |
| Bonds redeemed to June 30, 1912 | 26,875.00 |
| Bond interest to March 29, 1913, add'l | 8,446.25 |
| Bonds redeemed to March 29, 1913, add'l | 3,750.00 |
| Loan from general fund | 40,000.00 |
| Total | $175,222.30 |

The surplus from operation is computed as follows:

On the credit side:

| | |
|---|---|
| The balance from above capital account | $ 19,757.18 |
| Inventories, assuming them the same on March 29 as on January 1, as shown on a detailed schedule, in the semi-annual report of that date.. | 17,035.40 |
| Personal property, cost $9,240.33, for autos, office equipment, etc., less depreciation. | 7,855.37 |
| Accounts receivable, due for light, power and street lighting, service rendered | 14,767.86 |
| Cash on hand | 3,984.09 |
| Total | $ 63,399.90 |

There is one charge against this of $35.00 for deposits of customers on hand, leaving $63,364.90 as the profit on operations after deducting bond interest paid and depreciation.

This profit is taken care of in the following accounts:

| | |
|---|---|
| Reserve for interest on investment | $20,813.29 |
| Gain on operating for 9 months, ending March 29, 1913 | 24,360.54 |
| Surplus | 18,191.07 |
| Total as above | $63,399.90 |

The gain on operating shown is the balance on operating account March 29, 1913, of $50,937.34 reduced by deducting nine months' depreciation of $18,130.55 and the bond interest paid as shown in the capital account, $8,446.25.

From the annual report of the plant of June 30, 1912, the reserve for interest on investment to that date may be computed by adding two items and is $75,150.79.

Mr. Dolge says with respect to this:

"The reserve for interest on the average investment is an attempt to show upon the books of the lighting department the interest that would have to be earned upon the total capital investment if the plant were privately owned. There is no particular objection to such an account; however, it must be manifest that any credit balance appearing after bond interest has been charged off is part of the surplus profits, by whatever name designated.

"It would seem contrary to the best interests of the citizens of Pasadena to maintain a big reserve account for interest on the average investment merely because privately owned concerns are supposed to earn such interest. The department might with equal logic be called upon to set up a reserve for taxes which it does not have to pay."

He deducts from it bond interest of $12,818.75 paid out of operating surplus prior to June 30, 1912, and $41,518.75 bond interest paid out of taxes, leaving the balance of $20,813.29 as shown above, which is surplus additional to the $18,191.07 shown under that name.

The indebtedness of the plant on which interest should be paid by the plant is, according to the above statement of liabilities, the bonded indebtedness of $286,250 plus the contributions from taxes of $175,222.30, making a total of $461,472.30, about $24,000 less than the present value of the plant, the interest on which amounts to some $7,000 a year more than is actually paid. No one can object to the use of the profits of the plant in construction and the payment of bonds and interest out of the city treasury, if that is the most convenient and economical mode of procedure, but the accounts should show this clearly and the accounts of "Contributions from Taxes" and "Reserve for Interest on Investment" must show these facts clearly and the allowances to be made for them. The superintendent has tried to do this and should continue to do so. The net balance of interest reserve may be a portion of the surplus, but it must show the facts and should be kept as a separate account.

# SEWAGE PURIFICATION

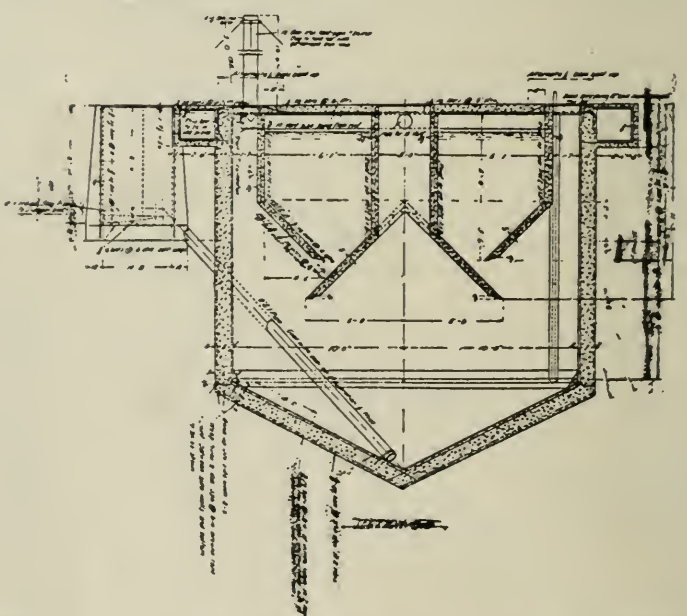
*By F. H. Tibbetts, Haviland, Dozier and Tibbetts, Civil Engineers, San Francisco, Cal.*

The sewage disposal works at Winters have been designed to accommodate a population of 3,000, which is twice the present number, so that no enlargement of the work will be necessary in the near future. The estimated daily sewage flow is 75 gal. per capita, 225,000 gal. for the assumed population of 3,000. There are two tank units with sludge digesting chambers capable of storing six months' sludge production. The chambers are 20 ft. in diameter and have an effective depth for storing sludge of 6½ ft.; the sludge capacity amounts to 1,950 cu. ft. for each tank or a total of 3,900 cu. ft. Estimating the amount of sludge at 0.007 cu. ft. per capita per day the amount from 3,000 persons therefore would be about 3,780 cu. ft. in six months.

Cross section of one of the tanks, showing method of applying the Imhoff principle is shown in the accompanying drawing. Communication between the upper and lower chambers of each unit is afforded by 10-in. slots. The trough bottoms slope toward the slots at an angle of 45 deg. which is assumed to be steep enough to allow the solids which settle on them to slide down and pass into the sludge chamber.

The sewage as it enters the sedimentation tank passes under two scum boards set 1 ft. apart with their lower edges 18 in. below the water surface. These will intercept floating matter and if the scum forms back of or between the boards it may be removed by raising the planks which cover this space. The arrangement at the outlet end of the tanks is identical with the inlet and provision is made for reversing the direction of flow periodically so as not to get a greater accumulation of sludge in one tank than in the other. The bottom of the sludge digesting chamber is an inverted cone with a height of 5 ft. and a diameter of 20 ft. The depth of sewage will be such that the sludge at the bottom will be under 19 ft. of water.

When the sludge is being removed water may be discharged into it from five points to stir it up and make it slide down to the intake of the sludge pipe. Around the base of the vertical walls at the beginning of the bottom slope is a 2-in. water pipe for flushing, dimly shown in the drawing. There are four 1-in. openings spaced around the tank at 90-deg. intervals and a branch running to the lowest point of the tank. Sludge is to be removed from each by an 8-in. outlet pipe of cast iron coated with coal tar to protect it from the action of the sewage. The intake end of this pipe is at the lowest point of the sludge chamber and the discharge end is in a square concrete manhole 5 ft. below the sewage end of the tank and is fitted with a shear gate. When this gate is opened the sludge will be forced into the manhole from the bottom of the sludge chamber by a 5-ft. head of water and from here will flow by grav-



SETTLING CHAMBERS *and distributing channels above; sludge digesting chamber below; sludge removal pipe to manhole on left.*

ity to the sludge drying bed. This pipe is seen in the drawing, extending diagonally up from the bottom of the tank to the bottom of the manhole at the left.

The tanks are covered by a reinforced concrete roof 6 inches thick, high enough above the sewage surface to allow the formation of a sludge mat. Manholes 18 by 36 inches at the side and one 24 by 36 at the center of each tank are provided for removing this mat if it becomes necessary to do so. All parts of the roof of the sludge chamber slope toward one of these three manholes so that the gas bubbles from the working sludge will have free passage to the vents. A 10-inch galvanized iron pipe connects with each of the three gas chambers and extends 10 feet above the roof.

To give complete control of operation a 2-foot concrete channel to carry the sewage runs entirely around the tank and is provided with stop planks so that the sewage may run thru both tanks in reverse direction, thru the first tank only or by-pass both tanks. The major part of the sedimentation will take place in the first tank and it is proposed to reverse the flow thru the system every week or so in order to equalize the accumulation of sludge. If it should prove that one tank is sufficient for the present population to be served, the second tank may be by-passed and held in reserve until needed. The tanks are located near the site of a proposed public park. For this reason it was considered advisable to cover them.

IMHOFF TANKS *at Santa Maria, Cal. Manholes, partition between tanks and other distributing channels.*

### Operating Results at Winters

The Imhoff tanks at Winters have not been in operation long enough to give very definite ideas of what may be expected of them, as they were first put into service less than a year ago. The operation has been under the supervision of Mr. Luke Gregory, who, altho without experience in sewage disposal, has given unusually careful and intelligent supervision. Three progress reports have been obtained from assistant engineers since that time, but no analyses have been attempted. The last inspection was made on September 20, by the writer, in company with Mr. Gregory. The system is completed but all the houses have not yet been connected and the amount of domestic sewage delivered is much less than that for which the tanks were designed. The effluent from the tanks has been quite clear and comparatively free from solids, except at times some finely divided black humus matter. At first, while the flow was very small, a slight odor might be detected, but this appears to be hardly perceptible at present. During the greater part of the period of operation only one tank has been used. Lately a part of the sewage has been diverted so as to enter the outer end of each unit, being taken off at the center opening. This makes the tanks operate in parallel rather than in series as was intended.

Bacterial action is decidedly active, as evidenced by the continual rising of large quantities of gas bubbles. Most of these bubbles rise in the center manhole, which collects gas from the largest portion of the sludge wells. Altho gas was escaping in large quantities, no odor of hydrogen sulphide could be detected, even close to the open manholes. The heaviest mat was found in the center manhole of the first tank. This was about 5 inches thick, the manhole being 3 by 4 feet. All of the other floating solids would probably be not more than 6 more cubic feet making in all about 12 cubic feet of floating solid material in the entire tank. This is a very small quantity compared to the amount of material usually found in the floating mat of a septic tank, and indicates that a large proportion of the solids do not hold

enough gas to keep them continually floating. The mat was similar to that usually found on a septic tank, and when judged by the odors given off was not nearly so offensive. Some of the material from the lower part of this mat was taken out and examined. It consisted of a black homogenous mass containing very little fibrous material and having little odor other than that suggestive of tar or crude oil. The mat on the side manhole of the first tank was but about two inches thick, similar in appearance to that in the center. Bubbles were rising here also, but in not nearly such large quantities as appeared in the center. Bubbles were rising here also, but in not nearly such large quantities as appeared in the center. This was due also in part to the fact that most of the solids fall nearer the center of the tank, after passing thru the slots from the sedimentation chamber.

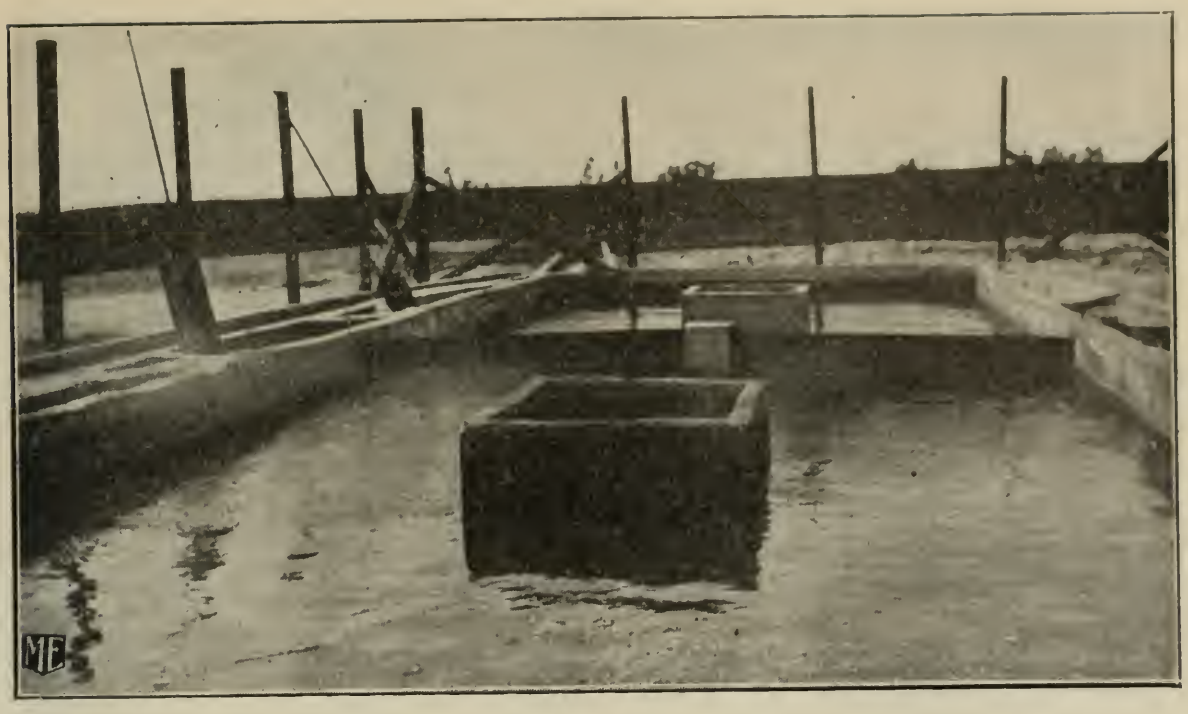
The sludge deposited in the bottom of the tank has been measured by Mr. Gregory, who found it to be about 2 feet thick. No sludge has yet been drawn out. Since the capacity of the sludge well permits of an accumulation of something over 6 feet, before this will become necessary, no observations on the character of the sludge from the bottom have yet been made.

It was found that a slight mat had formed on the sedimentation chamber longest in use. This mat was very thin, probably not over one-half inch, and its origin has not been definitely ascertained. The slope of the partitions between the sedimentation chamber and the sludge wells is 45 degrees, or one on one. It may be that some finely divided solids have remained on this surface for a period long enough for putrefaction to set in and have bubbles form, causing them to float. Or it may be that, as was observed in the Philadelphia experimental tanks, some solids are contained in the sewage which are light enough to float of themselves. Gas and scum is so small compared to the amount of sewage passing thru, that it cannot be a serious defect. Later designs of Imhoff tanks call for slopes of one horizontal to one and one-half vertical for these surfaces, and perhaps with such steeper slopes there would be less tendency for scum to form in the sedimentation chambers.

As will be noted from the description, a cover has been placed on the tanks. This was done in spite of the fact that both Dr. Imhoff and Dr. Rudolph Herring, of New York, considered it unnecessary. In general, a cover is, undoubtedly, not required. The writer however, believes it better to cover any sewage disposal works operated in close proximity to residences, as there is undoubtedly less odor in any type of works which is covered. At Winters, the pipes arranged for conducting the gas from the tanks have been brought together and extended so that the point of discharge is now about 30 feet above the ground. The operator states that previous to this there were on quiet mornings objectionable odors in the immediate vicinity of the tanks. This condition was relieved upon the extension of the pipes. The effluent has been concentrated in a closed iron pipe and taken down to the creek bed where it flows thru a channel in the gravel for a distance of about 100 feet to the main stream of the creek, which is very low at this season of the year. The only odors noticeable about the entire plant were in the 100-foot channel thru the gravel. This could be readily eliminated by diverting the flow of the creek so that the point of discharge of the tank would be under water.

The cover has been found efficient in preventing the use of the tanks as a breeding place for mosquitoes, and the operator has found it desirable to make all openings as nearly tight as possible except for the gas pipes and effluent pipes.

During the summer months a large amount of cannery waste, estimated by the operator as high as 150,000 gallons in 10 hours, was discharged into the sewers, and found its way to the tanks. This material is strongly alkaline from the use of lye in the fruit canning process. It is stated by the operator that upon its arrival at the tanks, sludge decomposition as evidenced by the formation of gas bubbles ceased. Also that the



OPEN IMHOFF TANKS *at Santa Maria, Cal., after six months' use.*

velocity of flow thru the tanks was too high to admit of thoro sedimentation, and that at such times objectionable odors were given off and the effluent was dark and contained considerable suspended solids. Normal action was quickly resumed, however, when the cannery wastes were diverted from the disposal works.

### Tanks at Santa Maria

Similar tanks have been constructed at Santa Maria, Cal., and were completed by us about six or seven months ago. These tanks are not covered, and the photographs show the layout and appearance of the tanks better than could be done with photographs of the Winters installation.

### Cost of Operation

The cost of operation has so far been nominal in both places. Both are small towns containing from 1,500 to 3,000 population and regularly employ a sewer inspector and engineer at a monthly salary of $75 to $125, whose business it is to inspect all connections, and plumbing, to attend to flushing out the sewers, and to give whatever incidental attention is necessary to the disposal works, the latter consisting usually of a visit two or three times a week for an hour or so.

### Relative Cost of Imhoff Tanks and Ordinary Septic Tanks

For comparative purposes, costs have been calculated per capita for two Imhoff tanks and for two ordinary septic tanks, recently designed by the firm with which the writer is associated. The costs are from actual contract prices. The capacities of the tanks are calculated on the basis of a sewage flow of 75 gal. per capita per day, with a 3-hour storage period for the Imhoff tank sedimentation chambers, and an 8-hour storage period for the septic tanks. All four designs are of first-class construction of reinforced concrete at locations at which the prices of labor and materials should be about constant. Later studies indicate that a 2-hour sedimentation period gives good results. The relative costs are shown in the following table:

IMHOFF TANKS.

| | Winters. | Santa Maria. |
|---|---|---|
| Contract price | $3,414 | $4,000 |
| Capacity of sedimentation chambers (cu. ft.) | 4,280 | 3,964 |
| Population Capacity—3-hr. storage period | 3,424 | 3,170 |
| Cost per capita—3-hr. storage period | $1.00 | $1.26 |
| Population capacity—2-hr. storage period | 5,140 | 4,760 |
| Cost per capital—2-hr storage period | $0.67 | $0.94 |

SEPTIC TANKS.

| | Pleasanton. | Lindsay. |
|---|---|---|
| Contract price | $6,667 | $8,250 |
| Capacity in cu. ft. | 14,560 | 17,470 |
| Population capacity—8-hr. period | 4,368 | 5,240 |
| Cost per capita | $1.52 | $1.57 |

### Conclusions

As compared with standard septic tanks, the advantage of Imhoff tanks can be stated as follows:

1. The construction of the tanks is such that gas from the decomposing solids is unable to rise thru the flowing sewage, and hence does not cause the turbidity of the effluent so common in septic tanks.

2. The sludge decomposition occurs in deep chambers, so that the gas is compressed in such a way as to remove the mechanical difficulties of sludge disposal, and the sludge after drying is easier to handle.

3. The gas generated is free from sulphuretted hydrogen and in general is quite inodorous.

4. The effluent, being delivered in a non-septic condition and comparatively fresh, is much less offensive and much more easy to deal with by subsequent treatment, whether by disposal on land, by dilution or by secondary works, such as filters.

5. The cost is one-third to one-half less than that of septic tanks of the same type of construction.

6. While no studies have been made to determine the exact proportions of sludge removed from the sewage by the Winters and Santa Maria tanks, and while no reports are available on the chemical or bacteriological content of the raw sewage and the effluent, it is believed from the standard of the non-technical observer that the plant is doing, and will do, what is expected of it.

7. There seems little room for doubt that under any ordinary conditions of sewage disposal the Imhoff tank is simpler, quicker in operation, less offensive and cheaper than the ordinary type of septic tanks.

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# TRANSPORTATION LINES AND CITY PLANNING

At the Chicago City Planning Conference Milo R. Maltbie, of the New York Public Service Commission, discussed city transportation facilities in relation to city planning, demonstrating the following statements:

(1) Main arteries should be straight lines.

(2) When the growth of traffic necessitates the provision of separate lines for (A) urban and (B) suburban and interurban traffic, the latter should not be permitted to stop at the outskirts and transfer to the urban system. They should be required to operate thru or across the city and do their own distribution and collection of traffic, as far as practicable.

(3) Thru lines should be adopted in preference to terminals.

(4) Elevated lines are less costly than subways and have many advantages.

(5) Freight should be delivered near the center of the city, and space utilized over and under freight yards. City and local electric lines can be used to distribute food products at night.

(6) The municipality should have perpetual control over transit facilities, so that their development may keep pace with that of the city.

# EDITORIAL

## ROAD MATERIAL AND MAINTENANCE

The report of investigations into the present methods and cost of building roads and maintaining them in Ashtabula county, Ohio, which is discussed elsewhere in this number of Municipal Engineering, again points the moral of the frequent sermons appearing in this department on the fitting of the material for the wearing surface of a road to the work required of it, and the necessity of even more attention to maintenance than to construction, especially if the lighter and softer materials are used for construction and traffic develops unexpectedly.

Too little attention has been paid and is yet paid to the increase in traffic which is certain on almost any main road as soon as the road grade and surfaces and the bridges are put in shape to carry it. The new motor traffic in particular is only waiting the opportunity to develop in a manner and to an extent only very slightly foreshadowed by the increase in such traffic in a few localities, most of them adjacent to large cities, where the roads have been improved sufficiently to admit it. What material shall be used for such main roads is therefore a much more important question than the ordinary county commissioner is disposed to think it. A few reports like that of Mr. Andrews will show these facts to enough people under different conditions to bring some more consideration.

The report shows also a lack of co-ordination of the forces constructing and maintaining roads which is altogether too common and a lack of system in keeping accounts and data of cost of construction and maintenance which leads to waste as well as to errors in plans for construction, maintenance and reconstruction which cause serious mis-applications of funds in all three. But those are other stories.

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## THE ENGINEER AND THE PUBLIC

The deficiency in the education of the average engineer with respect to his presentation of his work in good English in such form as to be con-

vincing to the reader or hearer who must be interested in what he is saying is likely to be overcome by means of courses in Engineering English, which are being established in various technical schools.

Municipal Engineering has called attention to this deficiency at intervals from the beginning of its existence; not so much because it is difficult to get engineers to supply the material about his work which the editor wants and in the form in which he wants it, altho that has long been a source of complaint about him; but because the engineer generally is not able to express himself in the manner which impresses the value of his work upon the public.

How often is the credit for a large constructive program taken by one who is able to put the parts of the project together and place them vividly before the public, when the actual development of the program in all its details, and often in its larger relations, has been worked out by the engineer, who stands modestly in the background, or is not heard when he presents his project because he cannot present it convincingly and interestingly to the non-technical investors or taxpayers, whose money alone can make the construction possible!

How many really second-class engineers there are, or men with no engineering ability or education, who have extensive reputations, but who are surpassed in every way but the power of expression by engineers who are seldom heard of but are classed as the "best by every test," but this one, by those who know them and their work!

The engineering publications are always anxious for the information about engineering projects and constructions, expressed in modest but strong and convincing manner, and would gladly displace with such material the matter which now too often has very close to the front the element of advertisement of the engineer or the projectors or the methods and materials used, and therefore is not so reliable nor, indeed, such good advertising material as the straightforward statement of methods, results, reasons and conclusions.

The engineering press is, however, more interested in the advancement of the profession and will do all it can to promote the establishment of such special courses in Engineering English as are now developing and being considered in several technical schools. Some of them have been at work long enough to show results, indicating the correctness of the opinion that this is one of the most important methods of securing general and full recognition of the engineering profession.

# QUESTION DEPARTMENT

## Information About Garbage Disposal

We are in receipt of copy of MUNICIPAL ENGINEERING, for which we thank you. You have a medium which should have a wide circulation, for in our opinion there is no field today where wasted values are given less attention by experienced engineers than in the cities of this country, although some excellent work in this direction has been done in recent years. The efficiency and scrupulous economy which prevail in many private industrial plants can be applied to a considerable degree in solving numerous and costly problems involved in the government of our American cities, and a more prudent expenditure of the vast revenues annually collected certainly can be effected if the services of trained men are employed, as in private works, to devise means for the preventing or recovery and utilizing of the waste now so general, to say nothing of better sanitation.

Our experience in developing and installing apparatus and processes for treating packing house by-products, under rigid government sanitary inspection, has taught us that the by-products of our municipalities can be handled by more sanitary methods, and also be made a source of substantial revenue.

At the present time we are particularly interested in the collection and disposal of garbage, and if you have any special numbers of comparatively recent date treating on this subject, or the subject of sewage disposal, we would request that you mail same to us.

H. F. ———, New York City.

There is a long list of previous articles on the subject of garbage collection and disposal on page 252 of vol. xlii, of MUNICIPAL ENGINEERING. Other articles in vol. xlii are "Automobile Garbage Trucks in Cleveland," page 328; "Street Cleaning and Garbage and Refuse Collection and Disposal," page 468.

In vol. xliii are several articles, such as "Motor Garbage Trucks in Homestead, Pa.," p. 53; "An Individual Garbage Destructor," p. 257; "Chicago Garbage Removal," p. 327; "A Book on Garbage Destructors," p. 329; "Methods of Garbage Collection," p. 391.

In the current vol. xliv are the following: "Automobile Truck for Refuse and Street Sweeping," p. 119; "Garbage Reduction in Chicago," p. 137.

The department of "Improvement and Contracting News" gives the latest concerning projects for cities.

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## Modern Gas Ordinance

There has been submitted to the City Commission of this city, at its last meeting, the following proposition:

An ordinance granting certain privileges to the company (a corporation) organized under the laws of the State of Arizona, its successors and assigns, in relation to the use of the streets and public places in the city of ———, N. D., for the purpose of laying pipes, mains and apparatus for the conveyance of gas, and to supply said city and its inhabitants with said gas.

What I want to get is a copy of the most up to date gas franchise, that is, most up to date in safeguarding the rights of the city, both at the present and in the future.

PRES. CITY COMMISSION.

MUNICIPAL ENGINEERING for March, 1912, contains a modern gas franchise, with due protection to both sides in the contract. The arbitration provided for in it has been operated once.

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## Slag for Concrete Curb

Can you advise me as to the merits of limestone vs. slag for concrete curb construction? If you can give me any comparative tests I will appreciate it.

J. N., ———, Ohio.

Can our readers give any information on this subject? The experience in the use of slag in concrete construction, indicates that it would not work well in outside surfaces of concrete. It will do well for foundations and for masses of concrete but it is probable that slag from any source would contain more or less material which would be acted upon by the weather and would stain or disintegrate the curb.

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## Regulation for Fire Protection—Business License Fees

1. I shall be very pleased to get some ordinances relative to fire regulation of a city of 3,000.

2. Also I will thank you for some basis or equitable rule for fixing licenses, i. e., for merchants, druggists, etc.

J., City Attorney,
——, Utah.

The usual fire ordinances include a definition of the fire limits within which special building regulations are applied, and occasionally building regulations are made for other parts of the city. For a small city this would probably not be necessary, but something like the following would be all that would be needed:

"No person shall use or occupy within the limits of ..... city, any building for the manufacture of turpentine, camphene, fireworks, nitro-glycerine, or other dangerous or easily inflammable or explosive substance, or for the storage of gunpowder in larger quantities than 28 pounds, or for the storage of fireworks of any description whatever. The quantity of gunpowder allowed to be stored under this section shall be secured in metal canisters, with metal stoppers or covers, such canisters not to contain more than 7 pounds each. The introduction of nitro-glycerine within the city limits is hereby prohibited, and any person having the same in his or their possession or under his or their control, within said limits shall be punished in the manner prescribed in section ..... of this ordinance: Provided, that dynamite containing no more than 60 per cent. nitro-glycerine may be brought into the city for the purpose of shipment.

"No person shall have, put or keep any hay, straw, cotton, hemp or wood shavings in stock, or piles without having the same securely enclosed so as to protect them from flying sparks of fire; and no person shall have or place in any stove, grate or furnace, or use in lighting or kindling fires in any private house, store, hotel, shop or other building, any kerosene, gasoline, benzine, naphtha or other highly explosive or inflammable substance.

"No lighted candle or lamp shall be used in any stable, building or other place, where hay, straw, hemp, cotton, flax, rushes, shavings, gunpowder or other combustible material shall be stowed or lodged, unless the same is well secured in a lantern.

"No person shall carry fire in or thru any street, alley or lot in this city, unless the same shall be placed in some close and secure place or vessel.

"No ashes shall be kept or deposited in any part of this city, unless the same be kept or deposited in a close iron, tin, or earthen vessel, or brick or stone ash house, thoroughly secured.

"No personal shall kindle any fire or furnish material for any fire to be made or kindled in any street, alley or vacant place within the city, unless by tinners, plumbers, or other mechanics in pursuing their business, requiring the use of fire, or for the purpose of boiling tar, pitch or oil to be used in the construction or repair of some building or vessel: Provided, that said fire shall be made in some crate or vessel, so that the same shall not emit sparks or otherwise endanger surrounding property.

"Every building more than one story in height shall have a scuttle through the roof and a convenient stairway leading to the same.

"Every chimney hereafter erected within the limits of ..... city shall be so constructed as to admit its being scraped, brushed, or cleaned, and all chimneys, smoke stacks and exhaust pipes shall be so constructed that the tops thereof from whence smoke or steam issues shall be higher than the tops of the surrounding buildings.

"No pipe of any stove, chimney or fire place shall be put up or used, unless the same be conducted into a chimney of stone or brick; and in all cases where a stove pipe passes thru the woodwork of a building it shall be separated from such woodwork at least 4 inches by metal or other incombustible materials.

"No person, firm or corporation or company shall permit the accumulation of boxes, paper, waste or other inflammable substance in the basement of any building or in or upon any building or premises owned or occupied by such person, firm, corporation or company, nor carry on any business, nor keep any shop, mill or other business or premises or either in the city of ..... in such a manner or condition as to endanger such buildings or property or any other shop or mill or other buildings or premises from fire or explosion.

"The chief engineer of the fire department shall have the power, and it shall be his duty to enter any building or enclosure to see whether the same is in a dangerous state, at such times as he may deem it necessary or whenever complaint shall be made to him in writing, and if they are in a dangerous state he shall report the same to the committee on fire department, and if such report is approved by said committee he shall cause such premises to be put in a safe condition. He shall also have power, and it is hereby made his duty to see that all chimneys, smoke-stacks, hearths, fireplaces, firearches, furnaces, ovens, stove pipes, kettles and any structures or apparatus that may be dangerous in promoting or causing fires, are constructed, reconstructed or altered in such a manner as to secure the greatest protection against fire. He shall also have the power, and it is hereby made his duty to require the owner or occupant of any blacksmith shop,

foundry, furnace, mill or other manufactory to erect, alter or reconstruct his chimney or smokestack so as to prevent sparks from passing into the open air, and no person after being so required or notified by the chief engineer to construct or alter any structure or apparatus, shall be permitted to use the same until the requirements to make the same safe shall have been complied with, and every person who shall neglect for 48 hours after being notified in writing or otherwise by the said chief engineer to comply with the requirements of this ordinance shall be punished as hereinafter provided.

"It shall be the duty of the chief engineer of the fire department and the police of the city to make complaints for any violations of the provisions of this ordinance.

"Any violation of or failure to comply with any of the provisions or requirements of this ordinance, or with any direction, notice or requirement given or made by the chief engineer of the fire department in pursuance of the provisions of this ordinance shall be punished by a fine not to exceed $300 and costs of prosecution, and imprisonment in the ..... county jail for a term not exceeding 6 months, or by either in the discretion of the court, and if only a fine and costs be imposed, the court may sentence the offender to imprisonment in the ..... county jail until the payment thereof, for a term not exceeding 3 months.

2. With reference to the subject of licenses: Columbia, S. C., has a very extensive ordinance covering all kinds of business. Much condensed it includes the following classes of business, each item covering one or more of the items included in the ordinance and the prices being for one year:

Merchants—

Wholesale, $15.50.
Retail, $10, $15, $20, $25.
Contractors, $15, $25, $50.
Distillery, $300.
Shows, $10, $25, $200 per day.
Electric Light Co., $150.
Street Railway Co., $300.
Gas Co., $100.
Glass Factory, $75.
Hotels, $25, $50, $75, $100.
Hucksters, $5, $10.
Insurance, $12.50, $20, $30 and up.
Itinerant tradesmen, repairers, etc., $5.
Junk shops, $100.
Kerosene, $100 and $10 and $15 per wagon.
Solicitors, $10.
Artists, $10, $20 and $30.
Architects and Engineers, dentists, lawyers and oculists and physicians, $10, $15 and $25.
Auctioneers, $50.
Agencies, $5, $10, $15, $20, $25, $50, $75, $100, $200.
Repair shops and small manufacturing shops, $10, $5 and $15.
Money lenders and brokers, $25, $50, $75, $100, $300.
Banks, $75 and $1 for each $1,000 capital above $75,000.
Barbers, $2 a chair.
Ice cream, soda, cigar stands, $5.
Billiard tables, $5.
Bowling, shooting, skating, etc., $10, $15 and $25.
Small trades, $5 and $10.
Clairvoyant, $100.
Compress, $25.
Laundries, $10, hand; $25 steam.
Mills and Factories, $10, $20, $25, $50, $100, $150, $200.
Printing offices and newspapers, $10, $25 and $100.
Peddler, $100.
Railroads, $100.
Stables and stockyards, $25, $50 and $100.
Telegraph companies, $100 to $150.
Telephone Co., $300.
Undertakers, $10, $50.
Warehouse, $100.
Wagons, $5, $10, $15, $20.

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## Regulation of News Stands on Sidewalks

I would like some information regarding ordinances regulating news stands on sidewalks. D., Chicago, Ill.

The city of New York has been fightig the news stands on the street until it has been able to do much toward removing them, especially where they seriously interfered with the traffic. This is so satisfactory that the Merchants' Association made a special effort to prevent a passage of a bill in the legislature which would nullify the work which has been done.

Most cities which treat this subject in their ordinances allow merchants from two to three feet of space next to the buildings in which to display goods, some of them requiring that no less than five feet of clear sidewalk should be left and some of them requiring still more. Detroit allows the merchants to use three feet of sidewalks if the sidewalk is 10 feet or more in width. Quite a number of cities prohibit the sub-leasing of this space to anyone else, thus cutting out fruit and news stands in front of houses not devoted to these purposes inside.

Atlanta, Ga., Bay City, Mich., Camden, N. J., Detroit, Mich., Evansville, Ind., Mt. Vernon, N. Y., are cities from whose ordinances the above has been gathered. The charter of Savannah, Ga., prohibits granting the right to any structure or obstruction in the public street. Nashville,

Tenn., grants permits for fruit stands projecting not more than thirty inches from the building. Some New Jersey towns permit the license of news stands.

The Omaha, Neb., ordinance reads as follows:

"It shall be unlawful for any person to keep or maintain any stand for the sale of fruit, merchandise or other article or thing, upon any sidewalk in the city of Omaha without first obtaining the consent of the occupant of the premises adjacent to which said stand shall be located, and without first taking out a license to be issued by the city clerk upon application to the city clerk and payment to him of the sum of $24.00 for the municipal year or $12.00 per six months: Provided, that all licenses shall terminate either June 30th or December 31st of each year: Provided further, that the granting of any such license shall not authorize or permit the location of any fruit stand in such manner or at such place as in any manner to obstruct sidewalk or to interfere with free travel thereon."

The city of St. Louis has a similar ordinance except the stand is charged the regular merchants license for the same class of business in addition to whatever it must pay the owner of the property for the use of the space in front of it.

Several of the cities mentioned require that all parts of the stand shall be removed from the street whenever it is not actually in use.

## Record of Meter Readings

We are endeavoring to secure a book for keeping records of meter readings and numbers and have been referred to you. If you have anything to offer in this line we would appreciate your kindness in sending us a sample page, or giving us full description of same P., Pittsburg, Pa.

The accompanying cuts show the meter card and the heading of the pages of the meter reading record used by the Otis building in Chicago, copy of which is kindly furnished by C. H. Lange, chief engineer of the building. This is for electric current. The record sheet has space at the left for perforations so that it can be kept in a loose-leaf record book.

METER READING RECORD

METER CARD _____ FOLIO _____

ROUTE BOOK _____

CONS. LEDGER _____

NAME _____ ROOM NOS. _____

RATE _____ BLDG. NO. _____ SIZE _____ SET _____

| DATE | READING | K. W. | BILL | DATE | READING | K. W. | BILL |
|---|---|---|---|---|---|---|---|

## Machinery for Making Electrolytic Hypochlorite

I am desirous of obtaining the names of firms who make machinery for making electrolytic-hypochlorite for water sterilization, also of devices for controlling the supply of sterilizing solution in proportion to the flow of water in mains and of plant for using hypochlorite of calcium.

Owing to the distance from which the latter has to be carried, I think it may be possible to make electrolytic hypochlorite cheaper. Ordinary salt costs 7 cents per lb., whilst rock salt cost only $12 per ton.

Can you give me any names of firms whom I can correspond with?

W. R., Regina, Can.

Can our readers give any information on this subject? Probably the General Electric Company or the Standard Electro-Utilities Co., of Chicago, could give some references. Makers of the product

METER CARD Folio _____

METER — SET — REMOVED

Meter Location _____ Room Number _____

Name _____

Maker _____ Maker's No _____ Building No _____

65% Demand Amp _____ Volts _____ Size Amp. _____

Index _____ Const _____ Set _____

TESTS

| DATE | BY WHOM | $+ | $− | DATE | BY WHOM | $+ | $− |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

ENTERED — Meter Reading Record — Route Book — Cons. Ledger

Meter Removed _____ Reason _____

are Castner Electrolytic Alkali Co., Niagara Falls, N. Y.; Hooker Electro-Chemical Co., 90 Wall St., New York; National Laundry Machinery Co., Dayton, O.; Siemens & Halske Co., 90 West St., New York; Pennsylvania Salt Mfg. Co., 115 Chestnut St., Phialdelphia, Pa.

## Sewage Disposal for a Small Town

How would a cesspool system answer for a disposal plant for a town of about 1,500 to 2,000 population, about 4 miles of sewers, by leaving some openings for some of the waste water to leach away? Are there patents on this of any kind?

D., Kane, Pa.

If, as seems probable from the information given, the sewers carry both storm water and sewage, the usual method of operation is to allow the ordinary dry weather flow of sewage to run into the disposal plant and turn the storm water out thru an overflow. Of course, there is a little sewage in this storm water, but so diluted that it is not seriously dangerous. The disposal plant may be a septic tank, which has been termed a "glorified cess-pool of any of the designs now on the market.

There are several patents on this sort of apparatus, the owners of which are listed in the Business Directory published in each number of MUNICIPAL ENGINEERING under the headings "Septic Tanks" and "Sewage Disposal," including the Cameron Septic Tank Company, 352 Monadnock Bldg., Chicago, Ill.; The Merritt Hydraulics Company, 117 N. Front St., Camden, N. J., Sterilization Company, 9 Clinton St., Newark, N. J., Pacific Flush Tank Co., 108 S. La Salle St., Chicago, Ill., and the City Wastes Disposal Co., 156 Fifth Ave., New York City.

## Information About Good Roads

We are undertaking a big bond issue for the building of public roads in our county and are in need of any and all information on the subject of good roads, hence I write for a copy of your magazine and anything else you can and will furnish us.

W., County Attorney,
——, Ga.

MUNICIPAL ENGINEERING keeps up with all the advances in road construction and is the best constant source of information.

The United States Office of Public Roads, Department of Agriculture, Washington, D. C., has much material which has been published by the government upon this subject. The American Highway Association, Colorado Building, Washington, D. C., is another source of material. Its good roads year book is a mine of information which can be obtained for one dollar.

There are several text books on road construction which would be of assistance, such as "Byrne's Highway Construction," $5.00; "Baker's Roads and Pavements," $5.00; a part of which is given to roads; "Hubbard's Dust Preventives and Road Binders," $3.00; "Morrison's Highway Engineering," $2.50.

## Cost of Hauling on Roads

Kindly advise whether you can give us comparative figures showing the cost of hauling on roads of various countries. I have noticed such tables published but can not locate any at this time. I have reference to a table that would show the cost per ton for certain distances on roads in France, Germany and other countries as compared with the cost of hauling on roads in the Unitetd States. We want these figures in order to substantiate our argument that the United States is far behind on roads.

R., Minneapolis, Minn.

The comparative figures referred to must be indefinite and not distinctly applicable, because the cost per ton of hauling on roads depends on wages, cost of feed for animals and the like, as well as upon grades and characters of surfaces. Better comparisons can be made by means of such figures as those given in the article on "Grade and Surface Required on Roads," which will be found on page 25 of the January number of MUNICIPAL ENGINEERING.

It is no longer true that the United States is far behind in the quality of its best roads. The fact is that the French government has a commission of engineers in this country which is spending an indefinite time in the study of American methods of building roads and their appurtenances and the results thereof. The United States is behind in the mileage of such roads, and the farther west we go the worse the conditions in this respect.

The average figures of cost of hauling two thousand pounds per mile in various parts of the United States were published some years ago by Gen. Roy Stone, when director of the United States Office of Road Inquiry. They have been criticised very severely at various times, but are given for what they are worth:

Eastern, 32 cents; Northern, 27 cents; Middle, 31 cents; Cotton, 25 cents; Prairie, 22 cents; Pac. Coast and Mountain, 22 cents; Whole United States, 25 cents.

In MUNICIPAL ENGINEERING, vol. vi, is a statement that "in Switzerland, 'the best highwayed country in the world,' one horse serves thirty people. In England, where the roads are admirable, the ratio is one to twenty-four. In France it is one to thirteen and a half. In the United States is is one to four, while in Indiana, one horse serves only three people."

Can our readers refer our correspondent to other comparisons of similar nature?

# WORKERS IN THE FIELD

## Distribution of Accounts of Road Construction

The Editor of MUNICIPAL ENGINEERING:

Sir—On page 328 of your issue for April, 1913, is a query from "G., Tex." regarding accounts. Possibly your correspondent would obtain some information by consulting the report of the State Roads Commission of Maryland on pages 114 to 133.

W. W. CROSBY,
Chief Engineer, Baltimore, Md.

The following, taken from pp. 122 to 126 of the report gives the classification of expenditures in the general accounts and the rules for entering expenditures in primary accounts, which may serve with very few modifications for county road work as well as road work under a state commission:

### A—Administration and Legal

1—COMMISSION SALARIES AND EXPENSES.

Salaries paid to the members of the commission, also all expenses when engaged on its work, such as railway fares, team and automobile hire, subsistence and incidental expenses.

2—COMMISSION—SECRETARY'S AND OFFICE EMPLOYES' SALARIES.

Salaries of secretary and all bookkeepers, clerks, stenographers and office boys in main office.

3—COMMISSION—OFFICE EXPENSES.

All office expenses of the commission, such as rents, telegrams, telephones, postage, messengers, books, typewriters, adding machines, stationery and office supplies.

4—COUNSEL'S SALARY, FEES AND EXPENSES.

Salary of counsel, and fees paid other attorneys which, from their nature, cannot be charged direct to a particular road or county. Also the traveling, subsistence and other incidental expenses of counsel when engaged on business of the commission.

### B—Engineering

*General.*

101—ENGINEER'S SALARY AND EXPENSES.

Salary of the chief engineer and his traveling, subsistence and incidental expenses when engaged on the business of the commission.

102—OFFICE EMPLOYES—EXPENSES.

Salaries of the chief engineer's secretary, clerks, stenographers and office boys.

103—OFFICE EXPENSES.

Office expenses of the chief engineer, such as rent, telegrams, telephones, postage, messengers, books, typewriters, adding machines, stakes, instruments, stationery and office supplies.

104—SHOP LABOR AND MATERIAL.

Labor and material used in the shop operated under the direction of the chief engineer.

105—INVESTIGATIONS.

Chemists, physicists or others engaged under the direction of the chief engineer in conducting tests and investigations, together with the cost of materials used in connection therewith.

*Preliminary and Construction.*

110—ENGINEER'S SALARIES AND EXPENSES.

Salaries and traveling expenses and incidental expenses of division engineers engaged exclusively on preliminary or construction work.

111—RESIDENT ENGINEERS' SALARIES AND EXPENSES.

Salaries, subsistence and incidental expenses of all resident engineers engaged exclusively on preliminary or construction work.

112—OFFICE EMPLOYES' SALARIES.

Salaries of clerks, stenographers, office boys, etc., employed in offices of division engineers.

113—OFFICE EXPENSES.

Office expenses of division engineers, consisting of telegrams, telephones, books, typewriters, stationery and office supplies.

### C—Construction—Preliminary

201—SURVEY PARTIES.

Salaries and expenses of engineers and their parties engaged in surveying and locating new roads.

202—DRAFTSMEN.

Salaries of draftsmen engaged in preparing the plans and drawings for the proposed new roads.

### D—Construction

All construction work should be done under regular contract or force work orders, which should bear distinctive numbers. An account should be opened for each such piece of work, such accounts to be grouped as to funds from which paid and counties in which work is located.

301—RIGHTS OF WAY AND DAMAGE.

Cost of land acquired for right of way, expenses of appraisals, expenses of commissioners or arbiters in condemnation proceedings, commissions paid for additional rights of way, removal of fences, payments for damages or repairs to abutting property, counsel's fees and expenses when specifically applicable to the cost of acquiring certain right of way and damages paid for delays because of lack of right of way.

302—GRADING.

Cost of grading, including ditch, masonry, culvert and bridge excavation, the excavation covered by the cross sections and from the borrow pits, the cost of operating steam shovels, scrapers and grading outfits, the hire of teams and equipment, rentals for the commission's equipment, rentals and the cost of miscellaneous tools and supplies used on the work. The cost of grading done under contract should be charged to this account from the vouchers in favor of the contractors.

303—SURFACING.

Cost of all labor employed and material used in surfacing, including the cost of operating stone crushers, spreaders, road rollers, sprinklers and oilers, the hire of teams and equipment, rentals for the commission's equipment used, the cost of miscellaneous tools and supplies used on the work, and in addition to the macadam or actual surfacing prescribed in the specifications under such head all paved gutters, curbing, concrete or other breakers across the shoulders when so used particularly and independently of the grading expressly for the purpose of improving the shoulders, and any material, such as sand, cinders or stone dust, used as a layer between the sub-grade and the surfacing proper. The cost of surfacing done under contract should be charged to this account from the vouchers in favor of the contractors.

304—BRIDGES AND CULVERTS.

Cost of labor employed and material used in construction of bridges and culverts, including the hire of teams and equipment, the cost of miscellaneous tools and supplies used on the work, all pipes, boxes, as well as culverts and bridges of all kinds used toward the end of disposing of the storm water coming to the road from above or from the surface of the adjacent lands. The cost of bridging and culverting done under contract should be charged to this account from the vouchers in favor of the contractors.

305—UNDERDRAINS.

Cost of labor employed and material used in construction of underdrains, V-drains, blind drains, sumps, standard underdrains and such other devices as are installed for the purpose of taking care of the ground or sub-surface water, the hire of teams and equipment and the cost of tools and supplies used on the work. The cost of drain work done under contract should be charged to this account from the vouchers in favor of the contractors.

306—ADVERTISING.

Advertising contracts for the work to be let.

307—INSPECTION.

Salaries and expenses of inspectors on the work.

308—SUPERINTENDENCE.

Salaries and expenses of superintendents in charge of work done by the commission's forces.

309—FINAL SURVEYS, PLANS AND ESTIMATES.

Salaries and expenses of engineers and their parties engaged in making final surveys, plans and estimates on the completion of each contract.

310—MISCELLANEOUS.

Rip-rap, tests and such items as are not chargeable under accounts No. 301 to No. 309, inclusive; also the amount of preliminary surveys and plans applicable to each contract when transferred from accounts Nos. 201 to 202.

All items of $50 and over should have explanatory notes made opposite the item in the detail ledger.

### E—Reconstruction

401—LABOR AND MATERIALS.

Labor employed and materials used in reconstruction of roads and turnpikes acquired.

402—TEAM HIRE AND USE OF EQUIPMENT.

Hire of teams and equipment and rental for use of commission's equipment on the work. It should include the labor employed and materials used in operating and maintaining the equipment in use.

| | | | | Per Cent. | |
|---|---|---|---|---|---|
| Total Expense $4,422,520 54 | Administration and Legal $62,910 51 1.4 Per Cent. | | Commission Salaries and Expenses | 50.33 | $ 31,666 42 |
| | | | Commission Secretary and Office Employees' Salaries | 23.41 | 14,728 05 |
| | | | Commission Office Expenses | 16.33 | 10,273 71 |
| | | | Counsel's Salary, Fees and Expenses | 9.93 | 6,242 33 |
| | Engineering General $56,318 72 1.3 Per Cent. | | Engineer's Salary and Expenses | 27.81 | 15,660 59 |
| | | | Office Employees' Salaries | 28.62 | 16,118 02 |
| | | | Office Expenses | 37.49 | 21,116 22 |
| | | | Shop Labor and Material | 5.01 | 2,820 29 |
| | | | Tests and Investigations | 1.07 | 603 60 |
| | Preliminary and Construction $4,126,911 46 93.3 Per Cent. | Engineering $56,056 90 1.3 Per Cent. | Engineer's Salary and Expenses | 27.96 | 15,675 81 |
| | | | Engineer Inspector's Salary and Expenses | 38.53 | 21,598 72 |
| | | | Office Employees' Salaries | 31.54 | 17,680 85 |
| | | | Office Expenses | 1.97 | 1,101 52 |
| | | Preliminary $59,907 12 1.5 Per Cent. | Survey Parties | 34.06 | 20,405 63 |
| | | | Draftsmen | 65.94 | 39,501 49 |
| | | Construction $4,010,947 44 97.2 Per Cent. | Rights of Way and Damages | 6.91 | 277,157 76 |
| | | | Grading | 15.45 | 619,652 83 |
| | | | Surfacing | 56.10 | 2,250,318 16 |
| | | | Bridges and Culverts | 12.65 | 507,214 33 |
| | | | Drains | 1.20 | 48,103 13 |
| | | | Advertising | 0.07 | 2,976 87 |
| | | | Inspection | 2.44 | 97,677 18 |
| | | | Superintendence | 0.40 | 16,242 81 |
| | | | Final Surveys, Estimates and Plans | 0.03 | 1,100 00 |
| | | | Miscellaneous | 0.37 | 14,789 26 |
| | | | United Railways Company's Work | 4.38 | 175,705 11 |
| | Reconstruction and Maintenance $128,949 47 2.9 Per Cent. | Engineering $14,293 25 11.1 Per Cent. | Engineers' Salary and Expenses | 19.07 | 2,725 21 |
| | | | Engineer Inspector's Salary and Expenses | 50.82 | 7,263 66 |
| | | | Office Employees' Salaries | 23.93 | 3,421 05 |
| | | | Office Expenses | 6.18 | 883 33 |
| | | Reconstruction $16,378 92 12.7 Per Cent. | Labor and Materials | 33.65 | 5,512 12 |
| | | | Team Hire and Use of Equipment | 21.46 | 3,515 02 |
| | | | Superintendence | 32.20 | 5,274 14 |
| | | | Inspection | 12.69 | 2,077 64 |
| | | Maintenance $98,277 30 76.2 Per Cent. | Labor | 22.20 | 21,820 41 |
| | | | Materials | 57.31 | 56,320 75 |
| | | | Team Hire and Use of Equipment | 13.66 | 13,419 10 |
| | | | Superintendence | 5.77 | 5,675 98 |
| | | | Inspection | 1.06 | 1,041 06 |
| | Equipment $47,430 38 1.1 Per Cent. | Construction | Rental charge for average time at 5 per cent. per month equals | | 14,563 00 |
| | | Maintenance | Rental charge for average time at 5 per cent. per month equals | | 595 00 |
| | | Reconstruction | Rental charge for average time at 5 per cent. per month equals | | 800 00 |

NOTE:—The above chart and figures are given to show the actual distribution of the total expenditures by the State Roads Commission to December 31, 1911. The segregation into items of work done is given on pages 28, 29, 30 and 31.

403—SUPERINTENDENCE.

Salaries and expenses of superintendents and foremen in charge of reconstruction work.

404—INSPECTION.

Salaries and expenses of inspectors on reconstruction.

405—MISCELLANEOUS.

Tests and such other items as are not chargeable under accounts No. 401 to No. 404, inclusive; all items of $50 and over should have explanatory notes made opposite the item in the detail ledger.

### F—Maintenance

501—LABOR.

Labor employed in maintaining existing roads.

502—MATERIALS.

Materials used in the maintenance of existing roads.

503—TEAM HIRE AND USE OF EQUIPMENT.

Use of teams and equipment in the maintenance of existing roads, together with rental for use of commission's equipment so used.

504—SUPERINTENDENCE.

Salaries and expenses of superintendents and foremen.

505—INSPECTION.

Salaries and expenses of inspectors.

506—MISCELLANEOUS.

Tests and such other items as are not chargeable under accounts No. 401 to No. 404, inclusive; all items of $50 and over should have explanatory notes made opposite the item in the detail ledger.

### G—Equipment

To this account should be charged the purchase price of all equipment which may have a substantial value after it has been used on any particular piece of work, such as road rollers, crushers, scrapers, graders, sprinklers, horses and wagons, auto trucks, etc. Small tools and other equipment which quickly wear out or become valueless should be charged to the work for which purchased at the time of purchase and upon the completion of such work should be appraised and credited to it.

The commission's equipment should be inventoried and numbered, and a proper record kept thereof. Charges for the use of the equipment should be made against the work on which it is employed, the credits for which may be carried in a "depreciation reserve" or "rental" account.

### Rules for Distribution of General Accounts

The monthly total of the engineering expenses, accounts 110-113, specifically applicable to preliminary and construction work, should be charged to Construction Preliminary and to Construction in proportion to the total amounts charged direct to those accounts during the month.

The monthly total of the engineering expenses, accounts 120-123, specifically applicable to reconstruction and maintenance should be charged to Reconstruction and Maintenance in proportion to the total amounts charged to those accounts during the month.

The monthly total of Administration and Legal, accounts 1-4, and of General Engineering, accounts 101-105, expenses should be charged to Construction, Preliminary, Construction, Reconstruction, and Maintenance in proportion to the total amounts charged direct to those accounts during the month, including the specifically apportioned charges for engineering expenses.

Exception: No part of the overhead charges is to be added to the maintenance expenditures made from the allotments of the motor vehicle tax to counties for maintenance of State Aid roads.

Using the above classification of accounts and following the instructions for distribution to the general accounts, the accompanying table shows the expenditures of the Commission to Dec. 31, 1911.

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## Concrete Pavements in Davenport, Iowa

The Editor of MUNICIPAL ENGINEERING:

Sir—The first concrete pavement in the city of Davenport, Ia., was completed in the fall of 1909 and comprised only a little over 3,000 square yards. In 1910, about 16,000 square yards was laid. This was widely distributed and consisted of small jobs, and the type was considered as a more or less dubious experiment. By the spring of 1911, some of the paving laid to date withstood two winters and two seasons of traffic. Its condition at that time seemed to warrant the continued use of concrete. During 1911 there was laid over 18,000 square yards of concrete paving in the city, and the adjoining town of Bettendorf, with a population of about 900, laid in the summer of 1911 a little over a mile of concrete paving in its main street, consisting of nearly 29,000 square yards in one job.

In 1909-10 the concrete pavement was laid under specifications briefly as follows: A 5-inch base of 1:3:5 concrete, with a wearing surface of 1:1 sand mortar, was corrugated transversely with tooled grooves about 8 inches apart. The mineral aggregate was river sand and 1½-inch crushed limestone. A transverse expansion joint filled with pitch was required every 50 feet. In 1909 the price on the only piece laid was $1.25 per square yard; in 1910 the price varied from $1.27 to $1.37 per square yard. The same year

a number of residence alleys were paved with one course of 1:3:5 concrete 6 inches thick and rough-finished, at an average price of $1.11 per square yard. During the fall and winter of 1910-11, the writer noticed that almost without exception these blocks of paving 50 feet long and 30 feet wide had developed irregular contraction cracks. While these cracks were negligible as to size, they were without question a failure and detrimental to the life of the pavement.

With the idea of a general bettering of the work, and in an endeavor to do so without materially increasing the cost, our specifications were changed before the season of 1911 to call for a 5-inch base of 1:3:5 concrete, with a 2-inch wearing surface of one part cement to two parts sand, a 2-inch transverse expansion joint every 25 feet, and a 1-inch longitudinal expansion joint along either curb, and a 1⅛-inch contraction joint midway between the transverse expansion joints. All joints have tool-rounded edges, and are filled flush with asphalt. This divided the work into blocks of 12½ by 30 feet, and so far has practically eliminated all contraction cracks. The concrete pavement under this specification was laid in 1911 for $1.25 to $1.30 per square yard.

During the season the city also laid several thousand yards of concrete pavement consisting of a single course, 6 inches thick, of 1:2½:4 concrete, with the mortar flushed to the surface, floated, and either broom-finished or corrugated as the grade of the street required. This was laid under contract at a cost of 93 cents to $1.00 per square yard.

During this same season our department was required to pave a street the subsoil of which was decidedly treacherous, consisting largely of sawmill refuse, such as sawdust, chips, bark, etc., filled above the natural surface of the ground to a depth of 6 to 12 feet and saturated with river water. Both railroad and street railway tracks which parallel and adjoin this street settle from 18 to 24 inches annually where they cross this fill. As this street would be subject to heavy and high-speed traffic, in the writer's opinion a flexible type of pavement, such as the various forms of macadam, would neither withstand the traffic without constant repair nor be in the least self-supporting over what seemed almost certainly excessive and unequal settlement.

Owing to the very general demand of property owners last season by petition and otherwise, for concrete paving, the writer has again changed his specifications in the effort to obtain, if possible, the best and most substantial concrete pavement compatible with a moderate first cost. The present specifications call for a 5-inch base of 1:3:5 concrete, upon which is laid a wearing surface not less than 1½ inches in thickness at any point, consisting of one part cement, one part of sand and one part of ¼ to ½-inch granite chips; transverse expansion joints consisting of creosoted long-leaf yellow pine blocks 1 inch in thickness placed with the grain vertical 20 feet apart; and the same longitudinal joints along the curbs as before specified. The prices received so far this season upon the pavement to be built under this specification have varied from $1.00 to $1.17 per square yard.

The writer prepared plans and specifications calling for bids on 29,000 square yards of concrete paving to be mixed 1:2½:4 with mortar flushed to the surface with a bar tamper, floated, and broomed; expansion and contraction joints to be placed dividing the work into blocks 12½ by 20 feet; and all to be filled with an asphalt filler. There were also 18,000 cubic yards of excavating; 11,000 linear feet of 18-inch concrete curb; 12,000 linear feet of 12-inch concrete curb. This latter was placed around a 10-foot center boulevard strip, which was left for the purpose of receiving a probable street railway line. The successful bidder on this work took the contract at 85 cents per square yard, 30 cents per cubic yard for excavation, 18 and 20 cents per foot respectively for the curbing. The ground for this work was first broken in the middle of September, and the pavement was completed and open to traffic in the middle of December.

This pavement was laid by the Hubbell Construction Co., of this city, and a Koehring Special Street Paving Mixer was used in the work.

A. M. COMPTON,
Commissioner of Public Works,
Davenport, Iowa.

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## Importance of Road Rolling

The Editor of MUNICIPAL ENGINEERING:

Sir—The County Road Commissioners of Menominee county, Michigan, started the development of a maintenance system in the spring of 1909 which promises, when all details have been worked out, to be an economical method of doing the repair and minor improvement work on the county road system.

The commissioners have under their charge 150 miles of road open to traffic. Of this about one-fifth is of gravel road or better; the remainder is of various grades of earth roads and offers problems in maintenance of every kind of bed from loose yellow sand to a clay sandstone hardpan.

Rolled roads are more durable, and in consequence the cost of repair and main-

tenance is greatly reduced. With coarser stone in the roadbed it is stronger to resist wear; and it is more securely bonded than where it is first rutted and mixed with mud. Less stone is required on a rolled road, as loose stone is largely forced down into the mud or is knocked to the ditches by traffic.

A good road should have a foundation of uniform strength, surfaced with a well-bonded coat of stone of uniform thickness. By rolling the sub-grade, weak spots are developed which can be filled with earth and again rolled to produce a uniform foundation. Earth for this purpose is cheaper than stone. When weak spots are brought to grade in this way, an even coat of stone can be applied and rolled to its permanent place. Only a roller will do this work.

Rolling is essential to the construction of a good stone road. It is impossible to build a stone road cheaply and durably without a roller, and the same is true with regard to the best class of gravel roads.

Councils in selecting a steam roller should choose the best; and respective merits should be carefully studied. A saving in first cost may be many times offset by the additional cost of operating or maintaining an inferior machine. Maximum results and fewest stops for repair are all-important in seeking true economy.

Rolling is not an added expense to the cost of a stone road. The cost of rolling is more than made up by the saving that results in several ways.

Coarser stone can be used in a road that is rolled so that the cost of crushing is reduced. Between stone crushed fine enough to be used without rolling, and the coarser stone suitable for a rolled road, there may readily be a difference in cost of from 8 to 10 cents a ton. This alone will nearly pay the cost of rolling limestone.

Roads built without rolling demand a great deal of attention for several years that is not given to rolled roads. The stone has to be raked to place from time to time; the earth sides have to be levelled where they have been cut up and destroyed; new material has to be added to fill hollows and ruts.

The road roller is one of the most important of roadmaking implements. Its use tends to greater durability, and consequent economy of maintenance. The cost of a road is largely dependent upon the amount of stone and gravel required; and by the use of a roller, the strength of the surface coating can be much increased, the drainage made more perfect, the life of the road lengthened, and in a given period a much less quantity of stone is required on the road.

A road should first be properly graded, crowned and drained. The roller should then be used to consolidate this earth sub-soil so that the gravel or stone placed on it will not be forced down into loose earth, but will form a distinct coating. When this foundation is prepared, the metal can be placed over it and rolled and consolidated into distinct crust.

It is one of the cardinal principles of roadmaking that the metal must form a distinct crust over the natural earth. This is not possible if the broken stone is dropped on a loose mound of earth, and is left for traffic to consolidate. To this end:

(a) Roll the earth subsoil before putting on the broken stone or gravel.

(b) Roll the broken stone or gravel until it is thoroughly solid.

A considerable portion of our machinery is supplied by the Port Huron Engine & Thrasher Co., Port Huron, Michigan.

K. I. Sawyer, Road Engineer,
Menominee County, Mich.

## Filler for Brick or Wood Block Pavements

The Editor of Municipal Engineering:

Sir—It is perhaps not an exaggeration to say that the success of block pavements, whether the blocks be of brick, wood, stone or granite, depends to a certain extent upon the filler used; and, furthermore, while paving units in block form exist which perfectly satisfy the requirements, the trouble has been mostly with the binding or filling elements.

The ideal filler is an asphalt artificially treated, so that it will not melt or chip within the range of heat and cold of the greatest of extremes of weather. So effectively does this treated and perfected asphalt take care of expansion and contraction that some paving engineers are using it for expansion joints, where other fillers are used for the body of the work.

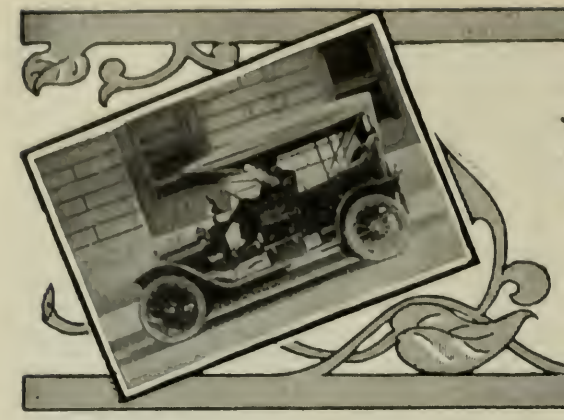
The following table shows the amount required for such purpose:

EXPANSION JOINTS ONE INCH WIDE PER LINEAL FOOT OF JOINT.

| | | |
|---|---|---|
| 12 inches deep | requires 5 | lbs. asphalt |
| 10 inches deep | requires 4.166 | lbs. asphalt |
| 8 inches deep | requires 3.333 | lbs. asphalt |
| 6 inches deep | requires 2.5 | lbs. asphalt |
| 4 inches deep | requires 1.666 | lbs. asphalt |

Used as an expansion joint filler, it makes up partially for the deficiencies of other fillers used with it; used for the whole work it gives a filler that always adheres to the brick and gives a true uniforrmity flush surface, is waterproof and sanitary; and in repair work can be removed from the units and remelted again and again as well as permitting the reuse of the paving units.

J. A. Johnson, Contractor,
Chicago, Ill.



# Automobiles in Municipal Service

## Motor Trucks in Municipal Contracting

*By H. W. Perry, New York.*

MUNICIPAL contractors, who are accustomed to handling large jobs, have adopted mechanical aids to their work to replace manual labor to such an extent that it is natural that they should adopt the motor truck to do the work done by horses and mules up to the present time. No work is now done by men on large jobs that can be done as well and quicker and cheaper by machinery. In street paving the concrete foundation and the tar and crushed stone surface composition are mixed on the spot, and in some cases distributed by power mixers that do everything but load themselves and rake the materials to an even thickness. The job is finished by steam or gas engine driven rollers. All that is needed in most cases to make street work an almost entirely mechanical job is motor trucks to haul the material to the mixer. Some contractors already are using them for this purpose.

Excavation work also is nearly all mechanical. On open jobs the steam shovel saves digging by men and hauling the earth and rock out of the hole with teams. In shafts and tunnels steam hoists raise to the surface the material loosened by steam drills. Here the power vehicle can complete the mechanical chain by hauling the rock and earth away to the dump.

In building operations the structural steel and stone are placed in position by steam derrick and the steel is riveted with pneumatic riveters. Possibly in time an ingenious and successful brick laying machine will be devised, but there is now ready at hand a proved mechanical means for hauling all the material that goes into the structure of public buildings. By its speed, reliability, endurance and general convenience it can expedite building operations just as surely as the other mechanical aids of the contractor.

Looking over the field of municipal contracting, it seems somewhat remarkable that, when contractors are so keenly alive to the advantages of the use of the various kinds of improved machinery and employ men trained in its use, they have not almost universally adopted the motor truck. Its advantages are so obvious that the reasons for such apparent backwardness must lie in some other direction. Probably it is due mainly to the fact that contractors very often do not own their teams but make a practice of hiring them.

### Contractors Have Awakened

As it is, however, more than 500 Amer-

HAULING ASPHALT *paving material in Garford tractor with dump wagon trailer, in Brooklyn Boro, by the Cranford Company.*

ican contractors in all lines of work are using about 750 motor trucks, according to *Power Wagon*. More than 500 of these trucks were purchased during the last year and a half and more than 400 others will go into contracting service this year, says the same authority. This shows that the use of power vehicles is a very recent development among contractors but that it is growing rapidly. So far there are few fleets of trucks in the contracting field, such as there are in express and department store services, from which it is safe to assume that most of the contractors who have them are testing out one machine with the intention of adding others if it does the work satisfactorily. The re-orders and fleets will come a little later. There are, however, half a dozen contracting companies that are using from twelve to twenty motor trucks each and nine or more that are using from six to nine.

### The Watson Fleet

One of the largest fleets is that of the Watson Contracting Co., of New York, which now operates eighteen Garford trucks, principally in street work. The company has been engaged recently on four contracts for grading streets and avenues in Bronx boro. The contracts called for the handling of more than 400,000 cubic yards of rock and earth in excavations and fills and also the hauling of crushed stone, screenings, ashes and gravel, cement, sand, coal, asphalt blocks, and other materials required in or incidental to the work. The materials were brought up the Harlem river and discharged by derrick into hoppers on shore, and were discharged from these by gravity into the trucks below. Each truck held five cubic yards and was fitted with a rear dump body, operated by hand-crank at the side.

The following data are given of two regular trips made by these trucks:

SUBWAY BUILDING *in New York, with motor dump truck by F. L. Cranford (Inc.)*

BUILDING STREETS *in Bronx Boro with Garford dump truck and tractor, by Watson Contracting Co.*

| | First Trip. | | Second Trip | |
|---|---|---|---|---|
| Distance from dock to fill | 1¾ | miles | 1¾ | miles |
| Load Carried | 5 | cu. yds. | 5 | cu. yds. |
| Running time, empty | 13 | minutes | 12 | minutes |
| Running time, loaded | 15 | minutes | 14 | minutes |
| Loading time | 1½ | minutes | 4 | minutes |
| Unloading time | 2 | minutes | 3 | minutes |
| Waiting time | 0 | | 3 | minutes |
| Total time | 31½ | minutes | 36 | minutes |

The material hauled at these trips was screenings; the streets were paved with asphalt blocks; there was one steep, winding grade and weather was good. The driver did not have to leave his seat, as helpers on the road raised the tail boards and tipped the loads. On this schedule, one truck could haul from 83 to 95 cubic yards in a ten-hour day. Two men, working day and night shifts, were able to make all necessary adjustments and repairs.

According to a member of the Watson company, each motor truck can do work equal to nine horses. On most jobs they have displaced the horses. The company sold forty-four of its horses in January and, having received the ten new trucks that were ordered about that time, will now dispose of all but fifty horses, which will be used in slow work and soft ground.

### Trucks for Bituminous Paving Materials

The Cranford Company, Brooklyn, has a fleet of seven trucks of the same make as the Watson Contracting Company's. They are, however, of the tractor type,

THE POWER DUMP TRUCK *for road building does the work of three to twelve teams. This Mack truck has just spread* 15,000 *pounds of stone as it was dumped, in about* 2½ *minutes' time, more uniformly than if by hand, and with saving of several men. Depth of spread perfectly regulated by driver.*

having a short wheelbase and fitted with a fifth wheel mounted on trunions almost over the rear axle. The trailers used with these tractors are the bottom-dump hopper body wagons formerly drawn by horses. The front wheels and axle have been removed and the necessary provision made for attachment to the tractor, as illustrated. These bodies were built for hauling asphalt for street paving, and are lined with sheet steel and interlined with asbestos to retain the heat.

The tractors have only recently been delivered to the company, so that no data on their performance are available. One of the great advantages of power trucks for asphalt paving is that their speed makes it possible to start with the asphalt heated to just about the proper temperature for spreading and to arrive at the scene of operation in a few minutes without letting the mixture have a chance to cool and harden. Another advantage is that more than half of the weight of the load is carried on the steel tired wheels of the trailer and this materially reduces the wear on the rubber tires.

The Warren Brothers Company, of Boston, has lately been using two five-ton White trucks for hauling material for laying bitulithic pavement in Cambridge. Pressed-steel rear-dumping bodies are fitted. They are elevated by power from the engines of the vehicles. The contractors charged the construction account $15 a day for each truck, but have found that the hauling was done at less cost than that of teaming. Added to this economy was the fact that two motor trucks could be managed with much less confusion and interruption of work than could six or eight teams which would have been required to do the work; also, that the trucks could be utilized, if necessary, after the regular day's work was over, to perform some special service as, for example, making a thirty-mile trip to bring a piece of equipment needed for the following day's work.

The power dump truck is one of the most efficient aids that the contractor can utilize. A truck not only has two or three times the speed of a team, but it can be backed into position in a fraction of the time required with horses and its load of three to seven tons or more can be discharged in a minute or less. By the simple manipulation of a lever from his seat, the driver connects the dumping mechanism with the engine and the engine does the hard work. Many such trucks are now made with automatic tail-opening levers and locks, by means of which it is possible to regulate the discharge as the truck moves forward slowly. Thus, it is possible to spread a load of crushed stone so evenly that it does not require any shoveling or raking, thereby saving much manual labor. Depth of the spread can be regulated by the driver from his seat.

Only when used in conjunction with other time-economizing and labor-saving machinery does the motor truck show its highest efficiency. It should not be used with slow loading and unloading methods nor be required to work on the same job with horses if it must be kept waiting from time to time for the teams to get out of the way. The crane and clam scoop, the hopper with chutes and similar quick-loading devices are enabling power vehicles to show remarkable results in the hands of large contractors. When such methods are used, the length of haul has little to do with comparative expedition and economy, because even with hauls of a mile or less the machines can be kept moving most of the time.

The Perry Sand Co., of Buffalo, which owns two Mack power dump trucks, uses the crane and clam scoop system of loading, and finds that one of the trucks does as much work as fourteen mules, and has

DUMPING BITULITHIC *paving material from White five-ton power dump truck in Cambridge, Mass., by Warren Brothers Company.*

cut delivery cost in half. (See p. 409 of May number for details and photograph.)

Other examples of the successful application of motor trucks to city work will be given in succeeding issues of MUNICIPAL ENGINEERING, together with some data showing the actual cost of operation per day and average cost of hauling a cubic yard or one ton one mile by power vehicle. There are so many facts to consider about the use of motor trucks by contractors that it is impracticable to do more in the space of a magazine article than merely to touch upon some of the more important of them in the hope that this will lead to careful personal investigation by the contractors themselves.

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## Motor Driven Combinations in Fire Department Service

*By Samuel F. Hunter, Chief of Fire Department, Springfield, Ohio.*

The city of Springfield, Ohio, not only enjoys the distinction of being the first municipality in this country to purchase a motor-driven pumping engine, but has reason to be proud of the fact that she was among the first cities in this section to realize the advantages and the savings of motor-driven combination chemical and hose wagons.

We have three of these motor-driven combinations in service and, while the financial saving over horse-drawn apparatus is considerable, the special advantage of being in a position of getting to a large number of fires in double-quick time and knocking them out before they gain headway, cannot be over estimated. The efficiency of our fire department has increased many fold since the installation of these machines, which are located in strategic positions, thus being enabled to make quick trips to the remotest parts of the city in four minutes time.

These motor-driven combination chemical and hose wagons were furnished us by the Kelly-Springfield Motor Truck Company, Springfield, Ohio. Every part of these machines is very carefully and durably made and it is my belief that the motor has fewer parts than any other 4-cylinder, 4-cycle head motor built. This motor is not only completely enclosed, including the valves, but the only moving parts exposed are the two cross-shafts in front, which drive the magneto and water circulating pump.

The magneto and water pump are driven by cross-drive in front and in connection with the French type of hood present an exceedingly neat appearance. By using an extra gear for the cross-drive the usual trouble of having too steep a spiral on the timing gear is done away with.

The equipment of our combination chemical and hose wagon includes 1,200 to 1,500 feet of 2½-inch hose, one 40- gallon chemical tank, two 3-gallon acid and soda chemical extinguishers, hose basket, 200 feet of ¾-inch hose, one nickel plated shut-off nozzle, one 20-foot extension ladder, one 12-foot roof ladder, together with the usual equipment of plaster hooks, pike poles, axes, storage battery, speedometer, lamps, lanterns, torches, nozzle plugs, etc.

The work done and the cost of operating one of these combination wagons is as follows:

For gasoline, grease and oils, per annum, $35.24.

Total mileage traveled, 417.

Total runs made, 133.

### Service of Motor Apparatus

Our motor-driven combinations respond to all alarms of fire in the city on first call and are always the first apparatus to arrive at the fire. Our combinations after reporting back at the engine house are ready for another alarm of fire 20 to 30 minutes sooner than our horse-drawn equipment, which responds to the same fire reports on duty with the horses sweating and blowing and tired and many times almost exhausted, and not in a condition to respond to another and immediate alarm of fire.

I recommended that the city council sell enough bonds to purchase at least five more auto engines, to be placed at the different engine houses, and do away with almost twenty head of horses, saving the city almost $4,000 per year on maintenance cost. Also the horses get lame and sick at many times during the year, and it is necessary to keep at least two extra horses to take the place of the ones that get hurt or sick. A hurt or sick horse cannot be worked; the veterinary services cost at least $100.00 per year. We have in the department now ten head of horses that are old, and getting stiff which will have to be sold and be replaced with young horses in the near future or purchase auto apparatus. So I believe it is cheaper, and we can get quicker and better fire service to purchase auto apparatus.

### Equipment in Service

There are 11,600 feet of hose in service at this time, 1 combination automobile engine, 3 combination chemical and hose wagons, 6 hose wagons, 1 aerial ladder truck, 2 service ladder trucks, 4 steam engines, 1 chief's buggy, 1 fuel wagon, 31 head of horses, all in good condition; in reserve, one 160-gallon chemical engine, 1 hose wagon, 1 buggy.

There are 600 fire hydrants in use in the city at the present time, all in good condition.

## Fire Horses Are Doomed

*By C. J. Lauer, Chief Columbus Fire Department, Columbus, Ohio.*

Motor-driven fire apparatus received its first actual test in the city of Columbus, on October 30, 1912, when two pieces from the Twentieth street engine house went to the home of C. P. Thompson, 1314 Clifton avenue, and extinguished a $250 fire before a horse-drawn engine from the Main street house arrived. The two pieces of automobile apparatus got to the fire, half a mile distant, in two and one-half minutes after receiving the call. A day later, I made a test of the new machines on East Broad street. The machine made 20 miles in 52 minutes, including the time required for turning. On the straight-away it is estimated the machine could make from 35 to 40 miles an hour.

The city fire problem is continuous and difficult. During the year ending December 31, 1912, for example, there were 739 fires and the loss entailed was approximately $400,000. This means that every fire lost on an average a fraction over $541 and the daily fire loss averaged nearly $1,100. Fully equipped and ever ready to do battle with the Columbus fire menace, is a small army of 274 men, including a commander in chief. Thrown over the personnel of this army is a mantle of protection in the form of a civil service which applies to all members of the department in appointment, promotion and removal. The chief alone can be appointed without the civil service and at the pleasure of the mayor. His dismissal,

SEAGRAVE TRACTOR *for steam fire engine in speed trial by Columbus, O., fire department.*

however, is impossible except for adequate cause. Thruout the department rigid discipline prevails. Unvarying obedience to carefully drawn rules and assiduous attention to duty are absolutely required. Intoxication in the department is a crime. No member may enter a saloon or even a grocery where intoxicants are sold.

Primary entrance into the department is shielded by fairly rigid physical and mental tests. Competitive examinations are provided. The applicant must understand and explain fairly simple propositions and must measure up to physical rules. Imperfect types are barred. The applicant must not be more than thirty-five years of age. However, the vigorous feats of strength and endurance prevailing in other cities are not compulsory. Substitute firemen are paid $2.75 for actual service. Regular firemen receive $1,100 annually, having been increased from $1,000 beginning this year. The chief of the department received $2,750 annually. The department has been costing the city approximately $330,000 per year. It will cost perhaps $30,000 more, owing both to salary increase and the installation of new engine house during the summer. All members of the department are on duty twenty-four hours each day, excepting three hours, which are given for meals. Each fifth day they receive a day off. This includes the chief. The telephone method of reporting fires is eclipsing the box system, altho boxes are still maintained everywhere thruout this city. All telephone wires are cleared to give right-of-way to the fire call.

In general equipment the department has shown a constant tendency toward the adoption of new and progressive apparatus. Motor-driven apparatus, to which the fire departments of the country generally are turning, comprises now practically one-fourth of our department. Four of the 17 houses are now fully equipped with motor-driven machines. These are headquarters house in Front street; No. 7 house in Euclid avenue, near High street; No. 8 in 20th street, near Mt. Vernon avenue, and No. 10 in West Broad street, at Glenwood avenue. Early next summer a new house is to be opened on the hilltop and only motor equipment will be placed there. Up to the present time, the motor equipment has cost $50,000 and I will soon propose a complete and almost immediate replacement of all horse-drawn apparatus. The estimated cost of the substitution is $130,000.

One of the prime tests of fire department efficiency is the promptness of response to alarms, and the main reason for the growing popularity of motor-driven equipment is its superiority in speed and lowered cost of operation over horse-drawn machines.

On February 17, 1913, speed tests were made in East Broad street, beginning at Fourth. The plan was adopted of having the horse-drawn apparatus run one mile, the motors covering the some course immediately afterwards, and applying the

SEAGRAVE MOTOR-DRIVEN *combination chemical and hose wagon, hauling horsepower steamer, Columbus, O., fire department.*

same procedure to the two and three-mile courses. A special committee followed the machine and took time records, which were as follows:

ONE MILE RUN.

*Horse-drawn Apparatus:*

| | | |
|---|---|---|
| Hose wagon No. 12.. | 3 min. 20 | sec. |
| Engine No. 12..... | 3 min. 38 | sec. |

*Motor-driven:*

| | | |
|---|---|---|
| Hose wagon No. 10.. | 2 min. 25 1/5 | sec. |
| Engine No. 10..... | 2 min. 40 | sec. |

TWO MILE RUN.

*Horse-drawn Apparatus:*

| | | |
|---|---|---|
| Hose wagon No. 11.. | 6 min. 10 2/5 | sec. |
| Engine No. 8..... | 7 min. 25 3/5 | sec. |

*Motor-driven:*

| | | |
|---|---|---|
| Combination engine with hose wagon tractor ..... | 4 min. 57 | sec. |

THREE MILE RUN.

*Horse-drawn:*

| | | |
|---|---|---|
| Hose wagon No. 12.. | 11 min. 56 | sec. |
| Engine No. 12..... | 11 min. 45 | sec. |

*Motor-driven:*

| | | |
|---|---|---|
| Hose wagon No. 10.. | 5 min. 55 | sec. |
| Engine tractor ..... | 7 min. 00 | sec. |

One disadvantage under which the horses ran was the almost continuous upgrade of their course. Even barring this, however, it can be seen at a glance that while the horses fairly held their own in the short distances, they were far outclassed in the long distance runs. In the three-mile run they were badly beaten and became pitiably exhausted.

Engine companies Nos. 1, 7, 8, 9, 10 and 17 are each equipped with Seagrave tractors, each of these companies having two to three tractors, with the exception of companies 9 and 17. All of our tractors, motor-driven combination chemical and hose wagons and hook and ladder trucks were furnished us by the Seagrave Co. This company also furnished us with our motor-driven coal supply wagon. Our tractors have 6-cylinder, 80-h.p. motors. Our motor-driven combination chemical hose wagons, each carry 1,200 feet of 2½-inch cotton hose, 100 feet of 1-inch hose, 200 feet of chemical hose, one 40-gallon tank and other regulation equipment. Three of our tractors haul horse-driven hook and ladder trucks while three haul steam fire engines. Two of our motor-driven combinations also haul steam fire engines.

At this time I am recommending the installation of sufficient motor equipment to completely change our entire fire department from horse-drawn to motor-propelled apparatus. The difference in cost of maintenance in favor of motor-propelled fire apparatus justifies this change, while the increased efficiency of motor apparatus over horse-drawn apparatus would be greatly beneficial to the working of the department.

Horses are an expensive luxury and the following report of our horse department, showing the various cases of sickness, lameness and other causes that were cared for, also the number of visits made during the year ending December, 1912, is but a fair idea of inconvenience and consequent expense:

| | |
|---|---|
| Azoturia ..... | 2 |
| Abscesses ..... | 2 |
| Cracked heels ..... | 2 |
| Colds ..... | 4 |
| Colic ..... | 3 |
| Destroyed ..... | 2 |
| Defective shoeing..... | 2 |
| Eye trouble ..... | 2 |
| Floating teeth ..... | 5 |
| Foot trouble ..... | 5 |
| Fracture of back..... | 1 |
| Lympathic trouble ..... | 6 |

| | |
|---|---|
| Nail punctures | 3 |
| Skinned and bruised | 6 |
| Strains | 15 |
| Indigestion acute | 6 |
| Blood poison | 1 |
| Kicked | 1 |
| Thumps | 1 |
| | 69 |
| Total number of visits | 140 |

## Fire Engine Tests at Milwaukee, Wisconsin

*By E. A. Wilkinson, Gen. Mgr., Nott Fire Engine Co., Minneapolis, Minn.*

On Tuesday, April 22, 1913, at Milwaukee, Wis., we made a demonstration with our 4-cylinder, 600-gallon machine, also our 6-cylinder, 900-gallon machine. These tests were made under the supervision of Chief Clancy, his master mechanic, and the fire committee, drafting water from a cistern and the results were as follows:

*Four Cylinder Machine.*

TEST NO. 1.

Two lines of 400 feet of standard fire department 2½-inch hose, each line equipped with 1⅛-inch S. B. nozzle.

Pump pressure, 160 pounds.
Nozzle pressure, 70 pounds.
Vacuum, 15 inches.
Gallons delivered, 626.

TEST NO. 2.

The same as test No. 1, siamesed into 1⅝-inch S. B. nozzle, Eastman Deluge set.

Pump pressure, 140 pounds.
Nozzle pressure, 66 pounds.
Vacuum, 16 inches.
Gallons delivered, 636.

TEST NO. 3.

One 800-foot line with 1¼-inch S. B. nozzle.

Pump pressure, 225 pounds.
Nozzle pressure, 55 pounds.
Vacuum, 10 inches.
Gallons delivered, 343.

The engine at no time on any of these tests exceeded 850 revolutions per minute. At all times you could lay your bare hand on the cylinders and leave it there on the entire test, showing the perfect control we had of our cooling system under these conditions.

*Six Cylinder Machine.*

TEST NO. 1.

Three lines of 300 feet of hose, each with 1⅛-inch S. B. nozzle.

Pump pressure, 135 pounds.
Nozzle pressure, 65 pounds.
Vacuum, 20 inches.
Gallons delivered, 903.

TEST NO. 2.

Four 200-foot lines, siamesed into 1¾-inch deluge nozzle.

Pump pressure, 135 pounds.
Nozzle pressure, 100 pounds.
Vacuum, 20 inches.
Gallons delivered, 909.

This test was made for one hour and thirty minutes run. The last thirty minutes of the run the pump pressure was 145 pounds and the nozzle pressure was 105 pounds, delivering 932 gallons of water a minute, and we can make either of these engines deliver their rated capacity hour after hour.

## Cement Production in 1912 Greatest in History

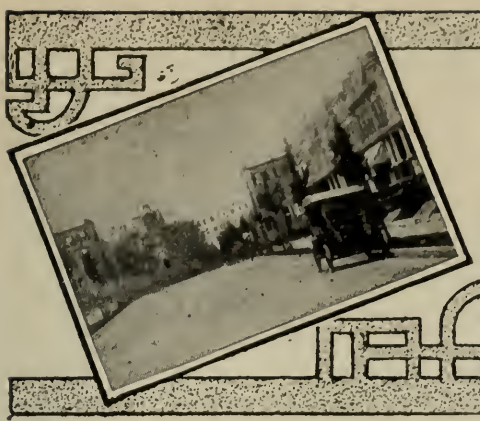
According to an advance statement by Ernest F. Burchard, of the United States Geological Survey, the total quantity of portland, natural, and puzzolan cements produced in the United States in 1912 was 83,351,191 barrels, valued at $67,461,513, compared with 79,547,958 barrels, valued at $66,705,136, in 1911. This represents an increase in quantity of 3,803,233 barrels, or 4.78 per cent., and in value of $756,377, or 1.13 per cent.

The distribution of the total production among the three main classes of cement in 1912 is as follows: portland, 82,438,096 barrels, valued at $67,016,928; natural, 821,231 barrels, valued at $367,222; puzzolan, 91,864 barrels, valued at $77,363.

The imports and exports of cement are reported to the Survey by the Bureau of Foreign and Domestic Commerce. The statements include all hydraulic cements, also the weights of sacks or barrels. Portland cement probably makes up at least 95 per cent. of the total in each year.

The imports of hydraulic cement in 1912 were approximately 68,503 barrels, valued at $93,558, or about $1.37 a barrel, compared with 164,670 barrels, valued at $252,722, or $1.47 a barrel, in 1911. This decrease in the quantity of cement imported was to be expected in view of the large excess domestic stocks that were marketed at low prices during the year.

The United States has a comparatively small export trade in cement. In 1912 the quantity exported was only 4,215,539 barrels, most of which was portland cement, valued at $6,160,341, or approximately $1.46 a barrel, compared with 3,135,409 barrels, valued at $4,632,215, or about $1.477 a barrel, in 1911. The quantity exported in 1912 was slightly more than 5 per cent. of the total production of hydraulic cements in 1912. The exports in 1910, 1911, and 1912 have shown increases of 135, 27, and 26 per cent., respectively, over those of the preceding year.

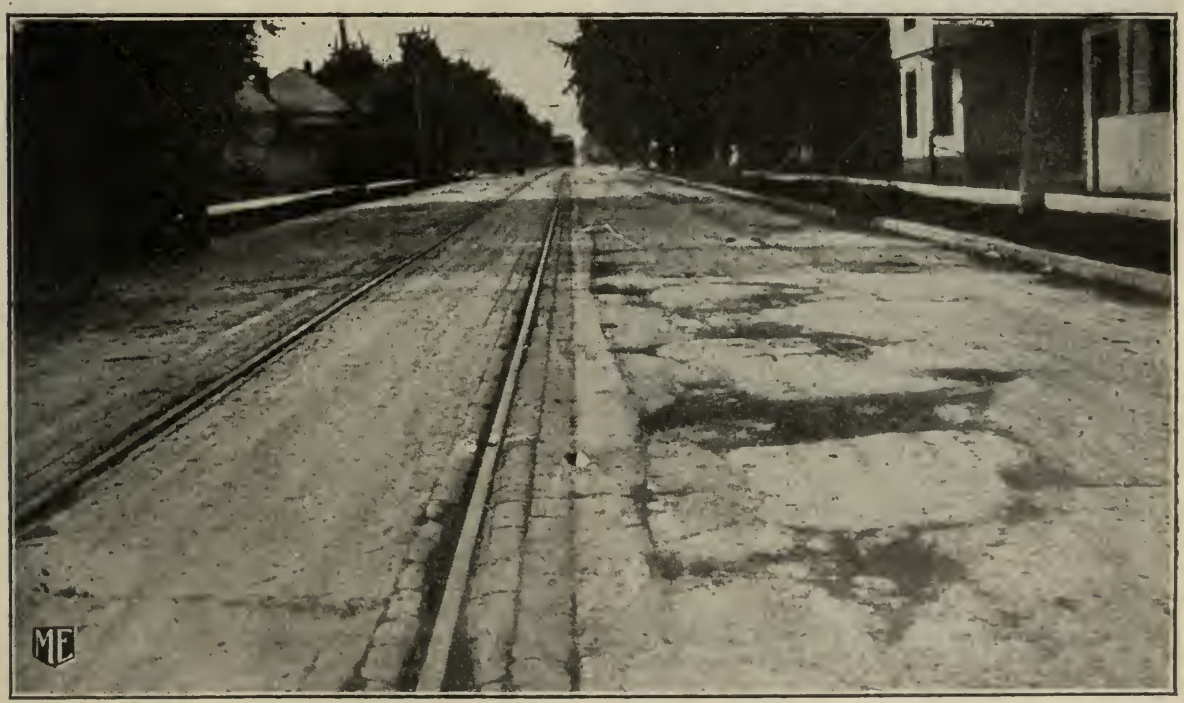


# ROADS AND PAVEMENTS

## Concrete Pavement Failures

*By Morse-Warren Engineering Company, Carlinville, Ill.*

It is the purpose of this article to show as clearly as may be the general and specific causes for the numerous failures of recently constructed concrete pavements which are witnessed on every hand thruout the United States. Probably in no line of concrete work has the number or per cent. of failures been greater than for many of the failures in pavement work, yet here we find the greatest differences of opinion among engineers. Before attempting to prepare complete specifications, an engineer should have a knowledge of the principles of pavement construction in general, and of concrete pavements in particular. A lack of proper investigation of the engineering principles has foredoomed many concrete pavements to failure. Under the head of failure due to faulty specifications, come,



CONCRETE PAVEMENT *on Wyandotte street, Windsor, Can., six years old.*

in pavements, yet a few successes, here and there, proclaim that good service can be secured. After having made a careful study of concrete pavement failures, visiting numerous cities, and in actually building concrete pavements, we feel qualified to outline the chief causes for failure in work of this class as follows:

### Faulty Specifications

Under this head are found the causes

*First, Unscientific Design.*

This primary cause of failure is due to neglect to investigate the problem involving the forces acting upon large slabs of concrete laid upon the earth and subjected to the stresses incident to the rise and fall of the ground with every rain and drouth and with every freeze and thaw; also expansion and contraction due to the heat and cold, and the shock and jar of traffic, are to be reck-

oned with by scientific investigation. And while some of these forces cannot be ascertained with precision, they must be computed as nearly as possible.

The ignoring of the fundamental principle in the design of concrete pavements, that for any given area of slab, a certain definite thickness and strength is required to withstand the forces tending to rupture it, is a frequent cause of failure.

In this connection it may be said that a much more rational economical shape may be designed for the slab, than the uniform thickness generally required. In

CONCRETE PAVEMENT *on Toledo road out of Detroit, Mich., age 2 years.*

some cases which have been brought to our attention the slab is 20 feet in width and only 6 inches in thickness, which shows insufficient strength where no reinforcement has been used. In such cases, a proper amount of reinforcement or a reduction in the size of slab, or an increase in its thickness would have saved the failure.

*Second, Neglected Foundations.*

The proper drainage of the foundation is often overlooked. A trench filled with cinders or stone or gravel must be laid beneath each edge of a concrete pavement, or better and cheaper a 4-inch tile laid below the edges to a proper outlet. The foundation must be kept as dry as possible because of the swelling and heaving action of the ground below the pavement when it becomes saturated with water. Owing to capillary attraction the ground beneath the pavement is sure to be saturated from the edge toward the center several times each year, drying out between wet spells, thus rising and falling an invisible amount, but sufficient to crack the concrete if not provided for.

*Third, Lack of Rolling.*

The writers have seen longitudinal cracks in block after block of almost new work due to the fact that proper rolling had not been required. Observation should teach that the center of an old dirt road is very compact and that unless the sides are made of equal compactness and density, the pavement, if of light design, will be sure to crack over the center of the old road. When the slab is to be located on a newly made fill a failure to remember that the center of the fill, as generally constructed, is more compact and will settle least, has often led to disaster where the stresses involved have not been provided for by proper reinforcement or otherwise.

*Fourth, Incorrect Proportions.*

The proportions given the concrete govern the strength of the body and the hardness of the wearing surface. The weaker the concrete, the thicker the slab must be made to give the required strength. The relation of cost and strength should decide this matter.

The wearing surface must be the very hardest obtainable with the best stone and the richest mixture. Several partial failures have been observed due to a wearing surface of 1-2½-5 and 1-2-4. By way of illustration, showing that the harder the concrete the better the surface, a pavement of 1-2-3½ proportions laid during the past year shows some wear in six months, with a traffic of about 300 vehicles per day, while another in the same locality, with about the same service, made with top coat of 1-1-1, shows no marks of wear. It is not economical to build the entire thickness of such durable material, hence two-coat work is recommended as having a wearing surface which offers about 20 per cent. more resistance to abrasive wear at a less cost for equal strength of slab, as will be demonstrated in a future article dealing with correct methods in designing and constructing concrete pavements.

*Fifth, Improper Materials.*

Several pavements have been recently inspected by us which show one the surface gravel stones so soft that a pocketknife would readily cut them in parts. These pavements after three months' wear show many basins cut out by the action of the wheels. Specifications which allow stone or gravel, any parts of which are softer than neat cement mortar, are likely also to contain other defects. Soft materials are also more liable to cause failure by cracking, thru lack of tensile strength. Neglect properly to grade the materials used, to secure greatest density, is a frequent cause of weakness. Dirty sand and water has very frequently been

given as a cause of failure even in the face of many tests showing that sand can contain at least 8 per cent. of fine loam or clay without appreciable loss of strength in concrete.

A great difference exists in the strength and soundness of various brands of cement. The writers have tested brands the past year some of which show a 28-day strength test of about 600 pounds and some give up to 800 pounds tensile strength. In a concrete pavement where the hardest surface and greatest strength of body is essential, why allow an upper limit of 500 pounds when 700 pounds may be obtained? By requiring a high test for a 1:3 mixture, 28-day test, on samples submitted at once, at least 20 per cent. increase may be obtained in the hardness of the wearing surface above that frequently obtained.

*Sixth, Lack of Screening.*

No matter how strong, clean and well graded the stone and sand, or how strong the cement, or how rich the mixture, unless they are delivered into the mixer absolutely clean and free from foreign matter, the pavement will be sure to show pit holes and weak spots which will start raveling and wear. Neglect to screen all materials delivered which show clods of earth, coal or leaves or wood, has caused much trouble. The writers have seen defects appear in one case in less than three months after completion of the pavement, and have counted not less than two hundred holes in a distance of a thousand feet on a 16-foot roadway, and the engineer of this job has a national reputation, which illustrated the haphazard methods at present deemed sufficient in this construction by many engineers.

*Seventh, Improper Mixing.*

Failure to mix all batches thoroly and uniformly with the same amount of water, stone and cement will cause an unevenness in the quality of the wearing surface and lead to trouble. Each batch must be of a uniform quality so that the finished pavement will present a surface of equal durability, and thereby prevent holes and ruts. There is less chance of trouble when the mix is made of jelly like consistency, allowing a man to sink above his ankles, but yet not so wet that the water runs from the mass and leaves the stone deposited in one pile and the sand and cement elsewhere. Specifications requiring that the concrete shall be thoroly tamped into place, seem academic to those who know the better things to be obtained; yet such a clause is still often included in published specifications.

*Eighth, Careless Placing of Materials.*

Neglect to sprinkle the foundation before placing the wet concrete, leads often to the earth absorbing a large part of the water which should remain to harden the mix. The batch must be placed immediately, and if in two-course work the bottom course will be wet enough at the time of application of the wearing course that a man will sink to his shoe tops, the top course being of a like wetness, a perfect bond is secured and there will be one solid block of stone when set. A failure to secure this bond has caused serious trouble. Both courses are struck to the proper height by an adjustable template.

*Ninth, Improper Finish of Wearing Surface.*

Grooving or brooming of the wearing surface is quite unnecessary on streets with grades up to 5 per cent. They are to be considered as a source of weakness, as they expose edges of concrete to traffic. Grooves on the surface are especially

CONCRETE PAVEMENT *on Carroll Lane, Greenville, Ill., built 1910; photographed, 1912.*

objectionable as they assist abrasion to begin and also cause increased shock to the slab from heavy loads. The rough brooming sometimes practiced is subject to the same objections. Both constitute an unnecessary expense to the taxpayer and injure the work. Any disturbance of the surface after setting has begun injures its texture and allows raveling to begin.

*Tenth, Faulty Joints.*

In many cases, as concrete pavements are at present laid, it is doubtless true that the expansion joint is capable of lasting as long as other parts of the work, but where pavements are laid by correct methods, the expansion joint in general

use today will become the point of weakness. For our own use we have developed a joint protector that does protect. We have observed instances where the joint measured 1¾ inches in width, which is four times the required width and favors most rapid abrasion. The severity of the wheel shock increases about as the square of the joint width.

The correct spacing and location of transverse and longitudinal joints, their width, finish and protection is a subject which deserves the space of a special article.

*Eleventh, Neglect of Protection.*

The best concrete pavement that can be laid may be and often is absolutely ruined by not protecting it from the action of the elements when first laid. The writers have observed serious cracks appear in a pavement two hours after laying, due to exposure to a hot sun and a dry atmosphere.

As soon as built a pavement must be protected from the heat of the sun, from frost, rain and drying winds, and only after it has finally set should the surface be exposed.

*Twelfth, Insufficient Curing.*

Concrete sets hardest and strongest when kept well moistened. It is absolutely essential to sprinkle the surface for a period of from one to two weeks, depending on weather conditions. Neglect in this matter has ruined the quality of many jobs.

A concrete pavement requires about twenty-eight days of warm weather in which to set sufficiently to withstand the shock and wear of average traffic, and in winter months it has been ascertained that much more time is required, depending on the average temperature above freezing. Many of the failures in the surface are caused by opening the street for travel at the end of seven or ten days.

*Insufficient Inspection.*

The writers have known of concrete pavements being laid without an inspector on the job. Any concrete pavement work should have the constant attention of a competent inspector, selected by the engineer, whose duty shall require him to be on the job before, during and after the time the work is in progress. He should be well posted on concrete construction and capable of commanding a salary of at least $100.00 per month.

No matter how honest the contractor or how good his intentions he has the men and mixers to look after, it is his duty to place concrete, and it is next to impossible for him to watch every detail and see that forms are true to line and grade, expansion joints finished with care, clean materials used at all times, and the other provisions of the specifications exactly followed.

The engineer should prepare a complete set of specifications and provide an inspector to see that they are followed, for a contractor's guarantee of a job is always very expensive to the public.

*Lack of Personal Supervision.*

Many cities are exceedingly economical in their employment of engineering services, to their large financial loss. Taxpayers should realize that successful concrete pavements are not built in a day, or in a careless manner and that they require a large amount of the best engineering skill and supervision. The engineer should himself inspect and accept or reject all materials submitted for use in the work, and should personally appear on the job each day, reserving final authority in all matters to himself.

As a general rule we would expect a failure in concrete pavements when handled by, or subject to political influences and its hindrances, or when the work is attempted at a price much below the cost of other standard pavements.

Modern motor truck traffic is to be reckoned with and a careful study should be made of traffic conditions as they may exist in five or ten years.

In conclusion it may be said that neglect in any detail outlined, will certainly mean loss to the taxpayer.

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## Louisville (Ky.) Creosoted Wood Block

The Editor of MUNICIPAL ENGINEERING:

Sir—Answering your recent favor, will state that I have just dictated letter to H. C. Nickles, Superintendent The K. P. & C. Electric Railway Co., Kingston, Ont., which reads as follows:

"I have your inquiry regarding wood block pavements in Louisville, Ky., on streets in which car tracks are located.

"We have three streets in Louisville which were paved in 1909 with 3½-inch 20-pound creosoted wood blocks. The street railway rails are 9-inch grooved girder rails. The track construction is the best we know how to build in this city, the ties being supported on 6 inches of concrete and are entirely covered and surrounded by concrete. The foundation of the pavement proper consists of 6-inch portland cement concrete on which was placed a ½-inch mortar bed in which the blocks were set.

"These streets have been in use almost four years and have not cost one cent for repairs necessitated by ordinary wear and tear. There has been a small amount of expense incurred by the street railway company on account of some damage done to the pavement by loose rail joints.

This trouble, however, has been comparatively small and confined to one of the three streets, the other two have given no trouble whatever. I do not attribute any of this trouble to the fact that the street is paved with wood block as you know as well as I that loose joints will destroy any kind of pavement.

"We have another street in this city which was paved with wood block in 1911. The tracks in this street and the wood block pavement were constructed exactly as described above and to date there has been no expense attached to this pavement for any cause.

"My personal opinion is that first class creosoted wood block pavement is the most satisfactory pavement now being laid when considered from all points. I would not hesitate to put wood block on a street where the traffic was medium or heavy regardless of whether the street contained car tracks or not. This opinion, however, is based on the supposition of grooved girder rails being used. I have had no experience with wood block on other rail sections and consequently would not venture to express an opinion as to its durability under such conditions.

"We have experienced no trouble whatever on account of expansion in creocoted wood blocks."

The three streets mentioned in above letter were, Fifth from Market to Jefferson, 1,700.6 square yards, Sixth, Market to Jefferson, 1,798.5 square yards; and Jefferson from Sixth to Seventh, 3,852.7 square yards. These were the first creosoted wood block streets laid in Louisville and are now almost four years old. The specifications call for Southern long-leaf yellow pine not less than 90 per cent. heart and the treatment with 20 pounds of oil. The oil was a straight coal tar product of about 1.12 gravity.

For the first two summers after these streets were paved considerable trouble was experienced from bleeding which I attribute to the specific gravity of the oil used. All three of these streets carry heavy traffic and have cost nothing for maintenance outside of the trouble mentioned in the above letter due to loose rail joints. In fact the streets improve with use, as under the traffic the surface becomes smooth and the joints almost invisible. These pavements to date are in much better condition on the quarters and center than they are near the gutters, where standing vehicles prevent the traffic reaching the surface. Alter the second summer the bleeding ceased entirely and there has been no further trouble from this source.

In 1911, Fourth street from Walnut to Jefferson, 4,756.9 square yards, was paved with creosoted wood blocks under the same specifications mentioned above except that the gravity of the oil was reduced to 1.10 but in other respects the conditions are exactly the same as those on Fifth, Sixth and Jefferson streets. This pavement has now passed thru its first summer without any signs of bleeding whatever. This street also contains double car tracks constructed as above and as the roadway is only 38 feet wide practically all of the traffic occupies the car tracks. Altho only a little over one year old the joints, where the traffic reaches the pavement, have become practically invisible. In all of these streets sand filler only was used in the joints, except where there was an opportunity for unusual vibration over track crossings, frogs and switch points; at such intersections asphalt filler was used.

We now have under contract about 2,500 square yards of creosoted wood block upon streets in which the conditions are similar to those mentioned above. One of the streets under contract, Main street, will carry as heavy loads as any street in the city, and I anticipate no trouble from this source as I believe creosoted wood block pavement to be more satisfactory under heavy traffic than under light. The pavement seems to require considerable traffic to keep it in proper condition. The pavement under contract is the same as has been built heretofore with the exception that 16 pounds of oil to the cubic foot will be used instead of 20 pounds. This change is in line with what appears to be the general practice thruout the country at the present time and I believe will furnish a pavement equally as satisfactory as one with 20 pounds of oil, and a certain saving in the initial cost.

All things considered it is my opinion that yellow pine creosoted block pavement is the most satisfactory now being laid. It is without question sanitary, noiseless, dustless and durable and costs very little for maintenance. Its appearance is also very pleasing. The only objection which we have experienced is that it is slippery in wet weather. Our experience has shown that it is very easy and economical to repair defects or openings in the street in such manner that they are hardly perceptible after repairing.

I do not know of any difference between the specifications in use in Louisville and other cities except that heretofore we have specified not less than 90 per cent heart. In the future, for economy, this will be changed to "square edges and sound."

To summarize our local experience I would say that creosoted wood block has proven very satisfactory in Louisville and has less objections to it than any other class of pavement with which we have had experience. The comparatively small area of this pavement laid heretofore is

due to an abundance of caution which prompted us to feel our way gradually in the use and merits of this class of pavement. However, the results are so highly satisfactory that I trust the yardage will be very materially increased in future years.

D. R. LYMAN,
Chief Engineer, Department of Engineering, Louisville, Ky.

## Paving in Chicago

The Editor of MUNICIPAL ENGINEERING:

Sir—The average cost of asphalt repairs for the season of 1911 was $1.085 per square yard. This is $0.084 less, per square yard, than our low cost of 1910. Our total cost of maintenance per square yard of $0.057 is lower by $0.011 than our low cost of 1910. This compares very favorably with the cost of asphalt repairs in various other large cities in the United States.

It is the policy of the administration to perform all work, wherever possible, by day labor.

Practically all of the brick streets out of reserve have been put in good condition and 1911 was the first year that an attempt has been made to repair all our brick streets. The most important item in connection with brick repairs has been the most complete rehabilitation of brick pavements in subways.

On account of the large amount of old granite block that has been replaced by creosote block in the Loop district, the cost of granite repairs was reduced from $39,323 in 1910 to $19,780.99 in 1911. The average cost of repairs in 1911 was $0.637, as compared with $0.598 in 1910. This increase in cost is due to the fact that smaller areas were repaired and consequently the repair forces were shifted about more frequently. This, as is well known, increases the cost per square yard.

Macadam pavements are in constant need of repair and attention. There were approximately 460 miles of this class of pavement out of reserve on December 31, 1911, and under jurisdiction of this bureau, and altho we are spending larger sums of money each year on these streets, the entire wheel tax fund is not sufficient to put all macadam streets in first-class condition and to meet the demands of property owners and various improvement associations.

In order to secure more permanent results on macadam streets with heavy traffic, repairs were made by using a course of two or three inches of crushed granite chips rolled in. Altho the initial cost is greater than the usual macadam repair, results obtained would indicate that the repairs will last much longer and thereby reduce the maintenance cost, extended over a period of three or more years.

All street repair work was done by day labor with the exception of the repair of asphalt pavements.

Previous to 1911 an emulsion of soap, oil and water was used with fairly good results. With an emulsion a macadam street must be gone over every two or three weeks and with our large mileage of macadam pavements it was impossible to keep the dust down. With the use of straight oil, however, one application a season is sufficient and we are able to cover the entire area of macadam streets. We find the use of oil more satisfactory, as it has proven to be a good binder and not only acts as a dust preventive, but as a good road preserver.

We have improved on our methods of applying oil by the use of portable boilers, equipped with pumps, which enable us to heat the oil in the tank cars; pump directly into our distributing wagons and apply the oil hot to the pavement, instead of cold. This results in a better penetration, thus doing away with an excess amount of oil on the surface, which previous to this method of application was the source of numerous complaints.

During the past two years many improved machines have been patented which insure a better distribution of the oil and it is the intention of the bureau to experiment with several of these devices, as they can be attached to our present sprinklers at very little expense.

Total number of square yards of macadam pavement oiled in 1911, 6,019,941; total cost, $86,504.62; average cost per square yard, $0.0143.

Pavement, cement walks, combined curb and gutter, concrete curb and concrete gutter constructed under the supervision of the permit division of the city of Chicago during the year ending December 31, 1911:

| *Pavement* | |
|---|---|
| Granite block | 561,495 sq. yds. |
| Brick | 137,219 sq. yds. |
| Asphalt | 66,361 sq. yds. |
| Creosoted block | 38,618 sq. yds. |
| Cedar block | 28,791 sq. yds. |
| Macadam | 19,368 sq. yds. |
| Planks | 967 sq. yds. |
| Concrete | 212 sq. yds. |
| Slag | 6 sq. yds. |
| Total | 852,837 sq. yds. |
| Cement walks | 371,041 sq. ft. |
| Combined curb and gutter | 30,687 lin. ft. |
| Concrete curb | 11,924 lin. ft. |
| Concrete gutter | 547 lin. ft. |

F. W. SOLEN,
Superintendent of Streets, Chicago, Ill.

# FIRE AND WATER

## Efficient Handling of Lime and Chemicals at the Columbus (O.) Water Softening and Purification Works

*By Charles B. Hoover, Chemist in Charge.*

Our very successful experience with the Jeffrey apron conveyor installed at the time of construction of our plant, has induced us to make another very similar installation. This conveyor has been used from the very first as a carrier of chemicals to the third floor of the head house where the solutions are made up. This conveyor, which is in the center of the storage house, and which extends nearly its full length, is driven by an 18-h.p. enclosed motor with a maximum carrying capacity of twelve bags per minute when running at a speed of 50 feet per minute.

At the time the water purification plant was put in operation, all of the chemicals to be used in softening and purifying the water, were handled and stored in canvas bags. The original chemical house consists of one large room, 59 feet 8 inches wide and 105 feet long, and has an estimated capacity of 900 tons.

The first consignment of lime, consisting of several hundred tons, was delivered in bags, each containing a net weight of 100 pounds. The bagged material was stored in the chemical store house, but before it could be used, it was air slaked and almost all of the bags burst, demonstrating conclusively the inadvisability of storing lime in bags. Further trouble was also experienced, while using lime delivered in bags, in maintaining a uniform application of the chemical to the water and it was found that the bags of lime varied in weight from 10 to 15 pounds per bag.

After this experience of storing sacked lime, it was decided to buy lime delivered in box cars, loaded in bulk. A reserve stock of lime amounting to about 60 tons was stored in steel drums provided with 8-inch screw tops. Arrangements were also made with the lime contractor whereby he was to ship the lime at a uniform rate of not less than 40 nor more than 125 tons per week as directed by the chemist in charge. The lime, as soon as received, was sacked, 90 pounds to a sack, by the workmen at the purification works, and it was planned to regulate the lime shipments so that the lime could be used as soon as received.

The amount of lime necessary to soften the water changes from day to day and during flood times or after heavy rains the hardness of the river water drops from 300 to 400 parts per million to 100 or 150 parts per million and these changes sometimes occur in less than four hours' time, consequently there were often six or seven cars of lime on the siding at the plant or in transit, in excess of that which could be consumed. Some of these cars were held as long as two weeks before being unloaded, because there was no available place to store the excess material. This condition of affairs resulted in a loss to the city, first because of the demurrage on cars, and secondly because the lime air slaked and lost strength. The cost of sacking and weighing the lime was high. It required five men working nine hours to sack and weigh a car of lime containing 20 tons and after the lime was sacked, it took 1½ to 2 hours to elevate the lime to the third floor of the head house, where it was again lifted by hand to the lime slakers. The cost of handling lime by this tedious process amounted to approximately $1.00 per ton. The work of sacking lime from cars proved to be a very disagreeable job, especially in hot weather, on account of the lime dust slaking on the sweaty hands and faces of the men. This slaking of the lime dust often resulted in severe burns and sores. It was thought that the disagreeable features attending the use of quick lime might be overcome by using hydrated lime in its place. Several carload lots of hydrated lime packed in 40-pound valve-type paper bags were received and used. This material was eas-

ily stored because the bags were square and could be closely packed, and as the lime had already had its affinity for water satisfied there was no trouble from swelling and bursting of bags. The material could be kept indefinitely without losing strength because it packs into a dense mass, rendering the penetration of carbon dioxide very difficult. However, it did not prove economical or satisfactory to handle and its use was abandoned.

The storage capacity for lime having become inadequate and the method of handling being unsatisfactory, the Superintendent of Water Works, Mr. Jerry O'Shaughnessy, authorized the writer to prepare plans and estimates for new equipment for handling lime. The equipment is similar to the installation in use at the coagulating plant of the St. Louis water works and consists essentially of a concrete bin, elevated on columns over the railroad tracks located between the head house of the water purification works and the sedimentation basins; a Jeffrey V-bucket conveyor and elevator for elevating the lime to the level of the head house roof; a screw conveyor for conveying it across and into the head house where it is dropped into tanks; and three scales for automatically weighing and dumping the lime into the old slaking tanks below. The storage bin consists of a concrete hopper, 25½ feet square, with bottom slopes of approximately 38 degrees with the horizontal, heavily reinforced to take the direct pull due to the weight of the lime and the horizontal thrust due to the bulging effect. The main weight is carried on four reinforced concrete beams, which are in turn supported by eight columns with flared footings, which take bearings on the solid gravel under the track bed. The storage bin has a capacity of 220 tons of lime or about 22 days supply, which gives ample storage for any emergency. The bin is rectangular in shape with the bottob hoppered four ways to a hollow center column. A small hopper with three inch mesh grating was arranged under the bin between the railway tracks above the ground line and extending up to about on a level with a car floor. A power shovel (such as is used for unloading grain from cars) was provided for handling the lime from cars on either track to this steel hopper. The shovel machinery and its driving motor were located on a steel frame up under the bin bottom and directly over the steel hopper. From the steel hopper the material is delivered by a short spiral conveyor feeder into a run-around V-bucket conveyor. This latter passes thru a pit below the ground level, parallel with the railway tracks, under the small hopper and spiral conveyor feeder, then up one side of the bin across the top, and down the opposite side of the bin. The conveyor trough across the top of the bin is arranged so that material can be delivered directly to the bin for storage or to a spiral conveyor leading off at right angles with the bucket conveyor and delivering to tanks in the slaking room of the head house.

The lime is reclaimed from storage by drawing it out thru the hollow center column and thru a steel chute extending from the column to the steel hopper, into which the material was at first shoveled from the car. The flow of material from the bin is regulated by means of a chop gate which is located in the steel chute just outside the hollow column and which is operated by hand. From the hopper the material is fed to the V-bucket conveyor and again carried to the top of the bin. This time, however, it is delivered to the cross spiral conveyor, which in turn delivers it to either of the three steel tanks located in the head house, one over each slaking tank, and which are supported by steel frames from the slaking room floor. These bins, which are of approximately ten tons capacity each, are filled every day, or oftener if necessary, so as to keep a small supply close at hand to feed the slaking tanks. From these bins the lime is delivered to automatic weighing scales which are located close up under the bins and which are arranged to automatically weigh out the lime in lots of one hundred pounds or less and dump it into the slaking tanks at regular intervals as desired. The connection between the bins and the scales is by means of short closely fitting telescoping chutes so that no strain can be thrown upon the scales by the tanks. These chutes are provided with rack and pinion valves to shut off the flow of material to the scales if desired.

From the above it will be noted that the only labor necessary for handling the lime when it is being delivered to storage is a man to operate the power shovel. When filling the small tanks in the head house, one man can regulate the chop gate in the chute from storage bin and also attend to the valves in the conveyor over each tank to see that they are closed when the tank is filled and the next valve opened. The attendant who has charge of the preparation of the other chemicals in the slaking room can also look after the automatic scales and the slaking of the lime.

The conveying machinery, steel tanks, roof trusses and ceiling for bin, which were installed by The Jeffrey Manufacturing Company, are of their standard quality in workmanship and design and are of such heavy construction that the depreciation on them will be very small.

All chutes and tanks are of ¼-inch thick steel plate and are made as near dust tight as possible. The spiral conveyors are 12 inches in diameter, or 3/16-inch thick steel flights and carried in 3/16-inch thick steel troughs. The bucket conveyor is made up of 18 by 16 by 8 inch V-shaped steel buckets spaced every 2 feet on two strands of 12-inch pitch steel-thimble roller chain. The chain is made up of 2½ by 5/16 inch steel side-bars, ¾-inch diameter pins, case-hardened steel bushings and 5-inch diameter rollers. The spiral feeder is driven at 35 r.p.m. thru a pair of miter gears with a chain and sprockets from the lower corner shaft of the up-going strand of the bucket conveyor. The bucket conveyor is driven by a belt-connected 18-h.p. motor thru a set of spur gears with two countershafts at 100 feet per minute. The cross conveyor is driven by a chain and clutched sprocket from the first countershaft of the bucket conveyor at 86 r.p.m., and can be thrown out of service when material is being delivered to storage. The motor is located up under the roof of the storage bin at one side of the bucket conveyor upon a steel frame which is supported from the roof trusses at one end and from the bucket conveyor frame at the other end. The bucket conveyor is carried across the top of the storage bin by a structural steel frame which spans the bin from wall to wall just above the bottom chord of the roof trusses, and which also carries all of the driving machinery. The bin is closed in at the top by a steel plate ceiling attached to 3-inch beams which are framed into the bottom chords of the roof trusses. Access to the interior of the bin is gained by means of a manhole in the ceiling plates.

The old method of handling the lime before the above installation was made, was to shovel the lime into cloth sacks in the car, weigh and tie 100 pounds in each sack, then carry the sacks into the building and place them on an inclined apron conveyor which extends up into the slaking room and discharges the sacks upon the floor. The available space in the slaking room for storage was very limited and only a few sacks could be carried up at a time, consequently, most of the lime was stored on the ground floor. This meant labor for double handling. It was also a difficult matter to secure labor for handling the lime in this old way, especially in summer, due to the fact that the lime could not be handled without raising a great deal of dust with attendant unpleasant results from inhaling it, getting it into the eyes, or receiving it on exposed surfaces of the body when moist with perspiration. With the new method of handling the lime, the only person who comes in contact with the dust sufficiently to be affected very badly will be the shovel operator in the car. However, even he is not affected as much as under the old system, in that a can be unloaded much more quickly than before so that he is not exposed to the dust very long at a time.

The labor of simply unloading the lime from the cars by the old method required on an average five men for nine hours each per car of twenty tons. This at the municipal scale of $2.25 per day of eight hours, amounted to approximately $12.65 per car or 63 cents per ton. With the new method, it requires the services of one man for approximately three hours to unload a 40-ton car at a cost of about 85 cents or 2 cents per ton. Using the amount of lime consumed last year as a basis, the superintendent of the plant estimates that he can save $3,300 this year on operating expense due to the increased facility of handling the lime. The city of Columbus is growing in population very rapidly so that more water is required each year to supply its needs, consequently, more chemicals will be needed each year to keep the purity of the water delivered to the city up to the the standard already established. As a result, the amount saved in the cost of handling the lime as compared with what it would be under the old methods employed, will be greater each year as time goes on. The total cost of installation including storage bin, power shovel, conveyors, tanks and scales was approximately $18,000.00. This year's estimate of saving means a return of 18 1/3 per cent. on the investment. In addition to this, the work is accomplished with much great ease and less worry on the part of the operators about securing the necessary labor and as to whether they have a sufficient amount of lime on hand at all times to tide them over any emergency.

The above will give the reader only a small idea of the possibilities of "conservation of energy," low costs of handling materials, as well as the increased quality of the completed product, which present themselves to the engineers and manufacturers who are interested in handling the general elevating and conveying machinery problems.

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## A Model Water Supply for Manufacturing Purposes.

IT is not often that a manufacturing corporation finds it necessary to develop a water supply as large as a large city would require and at the same time desirable to safeguard it from pollution. The Tennessee Coal, Iron and Railroad Company of Birmingham, Ala., which company is a subsidiary of the

United States Steel Corporation, has recently completed the works to furnish such a supply. The requirements of the ordinary municipal supply have been so fully met that a description of the plant will be of interest to the municipal official from every point of view.

Birmingham is supplied with filtered water obtained at considerable expense and not unlimited in quantity without still greater expense, and such industrial plants as the steel works have found it necessary to furnish their own supplies. In this case the supply need not be filtered, but, with this exception the supply is quite as carefully guarded as is usual for domestic supplies.

RESERVOIR DAM AND SPILLWAY *for water supply of*

The minimum supply to be provided was fixed at 25,000,000 gallons a day. A thorough study of all the available sources of supply was made by Morris Knowles, consulting engineer, taking ten months. Areas of watersheds, rainfalls at many stations on the watersheds, runoffs, sanitary conditions, were all studied in detail. The collection of rainfall and runoff data, secured in part with the cooperation of the U. S. Geological Survey, is perhaps the most complete which has been made for a like area.

Village Creek, from which a partial supply has been pumped for several years, was selected as the supply to be developed. The minimum flow of this creek is not more than 1,500,000 gallons a day. A reservoir to retain flood waters is therefore necessary. This reservoir is produced by putting a dam across Village Creek just above the mouth of Venison branch, which is about 6.5 miles from the Ensley plant. This dam was built 90 feet high and is designed so that its height can be increased 15 feet whenever required. The spillway is 10 feet lower, so that the full reservoir has a depth of 80 feet at the dam. One of the accompanying photographs shows in two cuts a panoramic view of the dam from the upper side, the rock ridge against which it abuts on the right and thru which the spillway is cut to discharge into Venison branch, the spillway itself with bridge over it, and the continuation of the ridge to the right.

A concrete lip for the overflow of the spillway was constructed and defines the flow line of the reservoir. In the view some of the solid rock shows beyond the concrete lip, not having been taken down accurately to its level. A bridge is seen spanning the spillway.

Village Creek runs away from Ensley and the water from the reservoir must be pumped to a high-level reservoir for distribution to the plants at Ensley and Corey. A coal mine with a steam power plant is located at Edgewater, between the two reservoirs and the pumping plant is located there. The intake from the Village Creek reservoir is in Camp branch, an arm of the reservoir and is 40 feet below the level of the full reservoir, so that this marks the available reservoir capacity. However, the storage capacity above the intake is over 2,000 million gallons, while that below is only 500 million gallons, so that 80 per cent. of the reservoir capacity is available. The present draft of water is about 28,000,000 gallons a day.

When 15 feet more height provided for is added to the dam and the lip of the spillway is raised by the same amount, the capacity of the reservoir will be more than doubled, as it will be 4,700 million gallons and the supply can then be depended upon to furnish 50 million gallons a day.

The location of the intake requires the cutting of a channel in Camp branch about 3,000 feet long. This channel and the tunnel, 8,280 feet long, from the intake to the pumping plant are large enough to supply 75 million gallons a day, by gravity, the fall being 0.61 foot per

thousand and the cross-section of horseshoe shape about 6 feet 3 inches high by 5 feet 6 inches wide. This tunnel is shown in one of the accompanying photographs.

Besides the 28,000,000 gallons a day taken from this reservoir, the steel plants use 6,000,000 gallons from other sources. Much of this water is used for cooling purposes and from 60 to 70 per cent. of it is run back into the reservoir to be used again. That used in the Semet-Solvay process works is too much polluted to be used again and is discharged thru a cast iron pipe about 7 miles long and 6 and 8 inches diameter into Village Creek below the dam. Experiments are being made on settling and filtering water from coal washers and on purification of sewage from Birmingham which enters the creek above the reservoir, so as to reduce pollution in the latter case and increase the amount of water that can be returned to the reservoir in the other.

The reservoir in its present condition covers 320 acres and is long, narrow and deep with two branches. The half of the total discharge which it does not hold may discharge over the spillway several feet deep. The dam provides for a depth of overflow of 10 feet. To show the care taken of the sanitary features it may be mentioned that trees and brush are removed from the banks of the reservoir for the space that would be covered by a rise in the water of 5 feet, thus providing that no ordinary fluctuation in water level will kill vegetation and produce objectionable conditions anywhere about the reservoir. The area of this strip is 70 acres. The whole bottom of the reservoir was cleaned and grubbed before it was filled, just as though it were to be used for domestic purposes. The possibility of stagnant pools where mosquito larvae might develop undisturbed by wind or current was also considered, and the observations that have been made with respect to the conditions of the reservoir in this regard have been close and accurate enough to serve as a successful defense in a suit in which one of the claims was the increase in number of mosquitoes since the construction of the reservoir. Analyses to show the condition of the water and the changes taking place in it on account of the construction of the reservoir and with the changes in the seasons were made once a week for the first year and are now made monthly.

When the maximum of 50,000,000 gallons a day is developed from Village Creek, if there should be need for further supply it can be developed by building a dam in Venison branch below the spillway from the Village Creek reservoir to hold the small amount available from that branch and the overflow from the Village Creek reservoir, the spillway being cut down to give free flow in either direction between the two reservoirs.

Observations of the evaporation from the surface of the reservoir are taken regularly. Three standard evaporation pans are located not far from midway of the length of the reservoir. Each pan is located on a float with a raingage and a recording anemometer so that the observations can be properly corrected. One float is located in the middle of the reservoir and one at each side. One of the accompanying photographs shows the general nature of the reservoir and the shores, showing the clearing near the water line and the rugged wooded steep slopes which are characteristic of the whole reservoir.

The photograph also shows a bridge across the reservoir for the railroad line used for hauling in construction material. Part of this railroad was already in existence for handling coal from mines in the vicinity. It was extended 1.6 miles to reach the dam site.

*Tennessee Coal, Iron and Railroad Co., Birmingham, Ala.*

RESERVOIR, *showing width, cleared shores, and bridge of railroad used to supply materials for construction of dam.*

The care with which each detail is worked out is again illustrated by the fact that the plans and methods for the development of the mines whose workings pass under the reservoir or which might affect it in any way must meet the approval of the chief engineer of the water department and are under his continual inspection.

The general form of cross-section and the method of construction of the dam are shown quite well by the photograph of the dam under construction. It was designed by standard methods and the additional 15 feet called for by the design can be added whenever desired.

The stone for the cyclopean masonry of which the dam is composed was quarried from the adjoining hills, much of it from the cut made for the spillway, and from the foundation. The general size and character of stones and the methods of handling after they reached the dam can be judged from the photograph. After careful test it was decided to use crushed slag for concrete,

The storage for slag, sand and cement, the stone crushers and concrete mixers were located on the right of the spillway as seen in the panoramic view, and the mixed concrete was run in cars over the bridge. Two cables spanned the gorge. One over the center of the dam had movable supports so that it could serve the up-stream part of the dam directly, the other was fixed over the lower side. Experience seems to have shown that the fixed cable should have been located over the up-stream face of the dam, which was nearly vertical, and the movable cable way should have covered the lower side with its greater slopes and consequent necessity for more flexible service. The derricks and cranes for secondary service are seen in the photograph.

The proportions of concrete used in the dam generally were 1 cement, 2½ sand, 5 slag at first and later 1:3:6. About 22 per cent. of the interior of the dam was composed of the large stones, deposited in the concrete as shown in the photograph.

The dam was faced, above and below, with concrete blocks, as being most satisfactory in appearance, ease of construction and cost. They were molded of the forms and dimensions needed for all situations and special demands. Thus the pilasters shown on the face of the dam are fitted exactly to their duties at a minimum of cost. These pilasters are located at four of the expansion joints with which the dam is provided, each joint extending entirely thru the dam from top to bottom. Expansion joints are located also at the abutments of the dam. The face blocks at each expansion joint were so cast as to give a hexagonal drainage channel just inside the downstream face to collect any seepage thru the joints and discharge it into a 6-inch vitrified pipe along the toe of the dam which, in turn, discharges into the creek below. The concrete coping blocks and the concrete posts and railing can be seen, tho small, in the panoramic view. The rails and posts are reinforced with four 5/16-inch rods and cost only 60 cents per foot of railing, including the posts.

The concrete blocks were made of 1 part cement, 2 sand, and 4 slag. The yard in which they were made was a level place near the storage, readily accessible to the mixers which delivered the concrete on cars the same as to the dam. The whole yard was covered by a revolving crane, so that forms, concrete, and finished blocks could be handled with a minimum of expense. The sheet metal form for the face has made a smooth surface and great care was taken to prevent honeycombing on it.

The first construction on the dam was the cut-off wall, which extended 20 feet below the bed rock on which the dam

TUNNEL *from reservoir to pumping station, concrete lining.*

rested. This wall was 8 feet wide at the bottom and 8 to 20 feet on top on account of variations in the quality of the rock. Several springs were found in fissures in the rock. Each of these was boxed in with a well calked wooden box from which a 2-inch iron pipe was carried up beyond the point to which the water from the spring would rise, the concrete being placed about these pipes, which were extended as the dam increased in height. While excavation was going on the water was pumped out, but while concreting was in progress the water was not disturbed. Permanganate of potash was pumped in the twenty pipes from the fissure springs to see whether it would appear anywhere on the surrounding surface, without result. Pumping water into the pipes at 60 pounds pressure showed that eight pipes were tight and twelve permitted water to pass. Into these twelve cement grout was pumped under 25 pounds pressure. When a leak developed, some of them as much as 75 feet from the dam, pumping was stopped until next day, and was then resumed at a higher pressure. After one to four applications of pressure, the last at 60 pounds, the pipes were found to be tight. Nearly 1,200 barrels of cement were used in this grout.

The base of the dam was 10 to 11 feet below the previously existing bed of the creek. It will be seen from the photograph that the dam was constructed in alternate sections and the expansion joints were constructed at the junctions of these sections. In the photograph will be seen three of the five vertical tiers of concrete header blocks which were set in the faces of the sections first constructed, to prevent the direct flow of water thru the joints. The whole face of the section was thoroly coated with coal tar before the following section was placed. Ordinary paving pitch was selected for this coating after a series of experiments to test the adhesion and brittleness of various compounds proposed. There is a very slight seepage of water thru the dam, which is attributed to the use of slag. It is too slight to be considered.

DAM *under construction. Note cyclopean masonry with concrete block facing, expansion joints, well for gate chamber, block storage and derricks for handling material delivered by cables from above.*

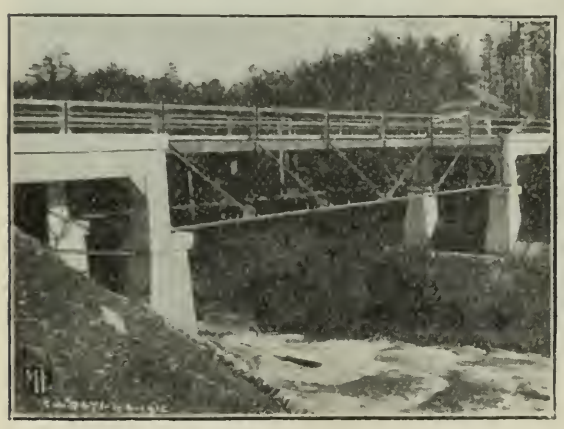
The large stone used in the dam cost $1.34 a cubic yard delivered at the dam. The concrete was placed at $3.11 a cubic yard and the concrete blocks cost $4.56 a cubic yard. Set in place the blocks cost

$6.72 a cubic yard, the coping blocks $9.66 and the railing $12.62.

In addition to the spillway, which is shown in one of the photographs and is ample for the 7 feet of water which it is expected may pass the 450-foot lip of the overflow, there are gates in the dam which can be opened as desired. Two of these gates are at the bottom of the dam, each being a 30 by 60 inch sluice gate. From the bottom of each well into which they open runs a 48-inch cast iron pipe thru the dam, with a 36-inch valve at the other toe. Cranks, racks and pinions operate the gates. Two similar gates are located 40 feet above the bottom of the wall. During construction of the dam one additional 72-inch pipe was in operation, the three pipes carrying the flow of the stream until the dam was completed, when the 72-inch pipe was filled with concrete. Stop planks can be used above the sluice gates in case they stick or are broken.

A recording water gage in the valve shaft keeps record of height of water and opening of gates is recorded so that discharge of water from the reservoir by way of gates and overflow can be estimated with reasonable accuracy.

Two 12,000,000-gallon Allis pumps have been installed and others are provided



OVERFLOW CHANNEL *from spillway and bridge used during construction for transfer of materials. Stone for cyclopean masonry was quarried from this excavation.*

for to be installed as needed, up to the conduit capacity of 75,000,000 gallons a day. These pumps force the water thru a 50-inch lock bar riveted steel pipe, 8,904 feet long, which connects with the distributing mains and also with the high-level reservoir, shown in one of the photographs, and which thus serves as an equalizer. This reservoir holds 17,000,000 gallons, is rectangular with rounded corners, 439 by 353 feet gross measurement, 20 feet depth of water and 25 feet height of sides, and was constructed partly in excavation and partly in embankment. The concrete lining, 6 inches thick, covers the bottom and the sides to elevation 3 feet above flow line. The mixture is 1:2.5:5 and alternate 10-feet-square blocks

HIGH LEVEL RESERVOIR, *partly in excavation and partly in embankment, serving as distribution or equalizing reservoir.*

were laid with expansion joints all round, filled with tar and concreted over.

H. M. Urban was chief engineer in design and construction; Morris Knowles, consulting engineer; William F. Wilcox was principal assistant during construction and is now superintendent in charge of the operation of the whole system. O. G. Thurlow had charge of designs and drafting; Hugh G. Stokes, of the construction of the reservoir and pumping station and their connections and appurtenances, and Eugene Underwood of the high level reservoir and main and distribution pipes.

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## Water Works of Daytona, Fla.

*By Geo. A. Main, M. E., Superintendent.*

No two water works managers have identical problems. Each meets his own particular problems, solves them more or less satisfactorily, and seldom takes the time to consider the fact that in some respects they are different from those of any other manager, and that for this reason a birds-eye view of his plant would be of interest to the managers of other water works. He forgets his own indebtedness to those from whom he has learned either by visits to other plants or by reading of them in some of the many good periodicals devoted to water works matters. The writer wishes to acknowledge his indebtedness to those with whom he has come in contact either thru their articles or personally, and with this as his apology offers the following description of the water works with which he has been associated since its construction in 1909.

Were it not for the need of fire pro-

tection before this plant was built this city might still have had no water works. Water for domestic purposes was too easily procured to make it probable that the city would bond for a plant for that purpose. In fact, practically every residence in the city was already provided with this available water supply.

Artesian wells with ample head to operate a small ram, which in turn with almost no attention would maintain an abundant supply of the artesian water in the elevated tank provided for the purpose, were procurable at small cost. To be sure this artesian water was quite hard, but most of these residences were also equipped with rain water cisterns

GEO. A. MAIN, M. E., *superintendent of waterworks, Daytona, Fla.*

capacious enough to meet the requirements for bath and laundry purposes, and had they not been so provided there was no intimation that a municipal plant would give them soft water.

It seemed obvious, therefore, that a municipal water works would be of use, chiefly at least, for fire protection.

In the fall of 1908 this city, by a very small majority, voted bonds to the amount of fifty thousand dollars for the construction of the contemplated system, and engaged Mr. Clarence M. Rogers, of the firm of D. D. and C. M. Rogers, civil engineers, of this city, to superintend the design and construction of the proposed system. The work was begun early in 1909 and the first tap was made in September of the same year. The requirements of the underwriters of course determined the size of the plant.

Like the hundreds of miniature water works then existing and some of which are still to be found in operation, the source of supply of the municipal plant was to be artesian wells. Four 6-inch wells ranging in depth from 170 to 250 feet and having a combined flow of about 1,600 gallons per minute at the ground level supply the raw water. These wells have a static head of about 12 feet above the ground. The raw water therefore flows by its own pressure into the three 60,000-gallon reservoirs in which it is treated for the removal of such foreign materials as aeration and the Porter-Clarke process will remove. The first of these impurities to be noticed is the ill smelling hydrogen sulphide gas ($H_2S$) with which these flowing waters are thoroly impregnated. And this is the first impurity removed.

The raw water enters these reservoirs as a fountain, shaped like an inverted cone. The aeration it receives in passing thru the air and in its subsequent splatter on the float in the center of which the fountain is placed, completely removes the hydrogen sulphide gas, after which the water falls into the reservoir. The raw water as it comes from the wells is clear and sparkling. Exposure to the light, however, results in a rapid growth of algae and by the time the reservoirs are full, which requires about three or four hours, the water is very dark colored, almost black.

In the application of the Porter-Clarke process 2.83 pounds of hydrated lime and 0.16 pounds of soda ash for each one thousand gallons of water to be treated are weighed out and mixed into a white-wash consistency in a cypress tank above the raw water. The amounts of lime and soda vary from time to time, the above being the present requirements.

The raw water is set in motion by means of compressed air, the air being pumped into the water thru orifices in the bottoms of the reservoirs, the orifices being so arranged as to produce a rotary motion as well as vigorous vertical agitation incident to the upward escape of the air. This air agitation, which is produced by a Blaisdell compressor having a capacity of 100 feet per minute, is continued for about 55 minutes after the introduction of the chemicals. This aeration, followed by the Porter-Clarke softening process results, after six or eight hours' settling, in a water as clear and sparkling as one could desire; softened to the extent of removing all the temporary hardness and reducing the alkalinity or permanent hardness from 300 parts to the million to below 70; free from the algal growth and the condition

which fostered it; and free from the unpleasant odor; a more healthful drinking water, with the hydrogen sulphide and carbon dioxide gases removed, with the bi-carbonates and chlorides of lime and magnesium removed, with the algae removed, and only the chloride of sodium left to represent the original chlorides and the mono-carbonate of lime to the extent of less than one-fourth of the original amount of lime left to produce alkalinity. After the settling process is completed the purified water flows by gravity into the clear water basin, from which it is to be pumped into the elevated tank.

One of the accompanying photographs is taken from the rear of the pumping station. In the foreground of this view are shown the three softening and settling basins. The one farthest from the observer is nearly full of the raw water. The reservoir nearest the observer is full of water in the process of being treated, the vigorous agitation of the lime giving it a very white appearance. The reservoir to the left is full of the purified water, the outlet pipe or "dipper," which in the nearer reservoir is clearly shown above and entirely out of the water, in this reservoir being submerged ready for the removal of the purified water to the clear water basin beyond when the gate valve intervening is opened.

This arrangement of removing the clear water from the settling basins is the in-

WATER WORKS OF DAYTONA, FLA. *Settling basins in foreground. Pumping station and elevated tank in rear.*

vention of the superintendent of the plant. When the clear water has been nearly all removed from a reservoir this dipper-like outlet pipe automatically

INTERIOR OF PUMPING STATION, *Waterworks of Daytona, Fla.*

rises, swinging on its swivel and so as to raise the open end entirely above the surface of the water. This open end remains above the water during the filling, softening, and settling of the water, thus entirely preventing either the raw water or the agitated mixture from entering the outlet pipe. When the water has sufficiently settled the opening of a valve allows purified water to enter the pipe and submerge it just beneath the surface where the water is most thoroughly settled, the two square floats shown suspended in the nearer reservoir and floating in the left hand one maintaining the draw-off pipe in this surface position during the entire process of emptying the reservoir.

A photograph shows one of the two pumping units and the air compressor used for aerating and agitating the water. At the right of the pump is the gasoline engine. To the left and in the foreground is the air compressor, which occupies a point precisely in the middle of the building.

The pumping unit not shown in the cut is identical with the one shown, the arrangement being reversed so as to bring the two discharge pipes together beneath the pressure gage shown in the cut.

The pumping outfit consists of two Rumsey triplex pumps with a capacity of 750 gallons per minute each, direct connected by two Hilliard clutches to two single-cylinder 50-h.p. Foos gasoline engines. Both engines are also clutch connected to the Blaisdell compressor so that whichever engine is in operation can be used to operate the compressor and thus purify and pump at the same time. An idea of the operation of the plant may be gained by noting that while the power plant is pumping water from the clear water reservoir into the 75,000-gallon elevated tank it is also agitating the raw water and chemicals in one of the three settling basins, and that while this is going on another of the reservoirs is filling with the raw water. At least three of the settling tanks are necessary in order that there may always be a supply of the purified water on hand. As the consumption increases more settling basins may be added.

It is interesting to note that the algae do not grow in the purified water. Until the softening plant was put in operation the clear water basin contained the raw water. The rapidity of the algae growth in the hard water was almost unbelievable. The growth was so rapid that no strainer could be feasibly used and quantities of the algae passed into the mains.

The water is distributed entirely thru meters. Meters are read quarterly and bills are payable from the first to the tenth of the following month. The method of charging is that familiarly known as the "readiness to serve" plan. A quarterly charge of $1.25 for "service maintenance" plus a charge for water in proportion to the consumption makes the water bill. In view of the absolute fairness of this plan and the obvious unfairness of the somewhat common "minimum allowance" plan, the writer has often wondered that the latter plan has been so widely employed in charging for water, gas, and electricity.

At any rate this decidedly unjust minimum allowance plan has crept into public utility billing systems, and some intelligent customers and millions of the masses are being discriminated against in a way which would immediately arouse their opposition if the scheme were applied to any other community. Any fair-minded man will admit the justice of paying a fair price for the goods furnished him and a fair price for the delivery of the goods.

The cost of delivery in the case of a water service may be considered synonymous with reasonable rental on the property devoted to the patron's exclusive use. Among other items it should cover interest and depreciation on the meter and other materials furnished by the water works, the estimated cost of keeping the meter in repair, the cost of reading the meter and billing and collecting, and an estimate of the value of the water which the meter allows to pass unrecorded. In fact with a reasonable margin of profit it should be a charge for all items except water recorded by the meter. This, as is the case with everything else we buy, should be paid for in proportion to the quantity used. This plan of billing for water is simply the minimum allow-

ance plan with the unfair feature thereof cut out; the "allowance" is reduced to zero gallons, and the charge reduced to a fair price for the "service."

This briefly is the plan followed with the Daytona water works. The quarterly bill is $1.25 plus ten cents for each thousand gallons of water used, whether the consumption is 1,000 gallons per quarter or 100,000 gallons. It will be noted that this is a sliding scale, working automatically and starting at one dollar and a quarter per thousand gallons and decreasing as it should with large consumers towards a minimum of ten cents per thousand gallons. It must be understood that these figures are given merely to illustrate a principle. They have been worked out for the particular conditions here, and are working satisfactorily. The above principles, correctly applied to any water, gas, or electricity service, would, it would seem, furnish a fair plan if indeed not the only fair plan for charging for the service.

As stated in the beginning of this article, the Daytona plant acknowledges its indebtedness to others; little claim to originality is made. The best possible goods at the most equitable rates is the aim. Our patrons are largely the well-to-do who come here to enjoy the unparalleled climate and scenery which have given Daytona the enviable title of "The Prettiest Winter Resort in the World," and not the least of the attractions which this city holds out to tourists in its water supply.

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## Special Commissions Will Repair Ohio Flood Damages.

In the most seriously flood damaged sections of Ohio, the millions of dollars that will be required for reconstruction of public works will be spent under the direction and supervision of local flood relief commissions. These commissions will exercise the authority of the directors of service in cities and of the county commissioners in counties, according to the provisions of a newly enacted state emergency law. While exercising the authority of the service directors and county commissioners, the commissions are presumed by law to act jointly with the local officials.

Flood relief commissions were appointed under the new plan on May 19 for the cities of Columbus, Dayton and Hamilton, and for the counties of Franklin, outside of Columbus; Montgomery county, outside of Dayton, and of Butler, outside of Hamilton. Members of the Columbus commission are Joseph M. Howard, Lee M. Boda, C. Edward Born and S. M. Levy. Thru an agreement they will act also for Franklin county. The Dayton commissioners are headed by John H. Patterson, president of the National Cash Register, who did much actual flood rescue work. The other members are Walter S. Kidder, M. J. Gibbons, Frederick H. Rike. The Montgomery county commissioners are Edward A. Deeds, William Stroop, Edward C. Weber, and Eugene Wuichet. On the Hamilton commission are James K. Cullen, George P. Sohngen, Rev. J. F. McNary and Benjamin Strauss. The Butler county commission is composed of S. M. Goodman, Benjamin Harwitz, T. C. Simpson and Charles E. Mason. All of the members of each commission are residents of the respective cities and counties for which they will act.

The commission plan of flood reconstruction is based on the theory that the damage in some localities was so severe that the local officials would be unable to cope with the situation. The legislature consequently created a state flood relief commission named by the governor, and gave all flood stricken localities the right to appeal to the state commission for the appointment of local commissions to take charge of flood rehabilitation. Under the law, 10 per cent. of the voters in any city or county are sufficient to petition for state aid. When such petitions are presented to the state commission, the latter first gives the mayor of the city or the probate judge of the county the right to choose the local commission and if the mayor or the judge fails to act, the state commission does the appointing itself, acting over the heads of the local authorities. In any event, the state commission must approve all such selections made. Thus far, all of the commissions have been named by the local authority amicably and have been approved by the state commission. There are no indications now that further local commissions will be asked for.

The amount of money that will be spent in public reconstruction by the commissions named is beyond calculation but it will be enormous. It is roughly estimated that in Columbus and Franklin county the rebuilding of public works will easily reach $1,500,000 and it may go higher. In Dayton and Montgomery the loss has been much greater and the Hamilton and Butler county expenditures may run close to the Dayton expenditures. The reconstruction will include streets, bridges, levees, public buildings, schools, parks, and all manner of public works. Extensive plans for flood prevention also are being made and these will add to the amount of funds to be dispensed.

Regarding the work and duties of local commissions the new law specifically says: "The commission of any municipality shall have, in conjunction with the

director of public service all the powers and duties of the director of public service in such municipality, in so far as they may extend to the repairing, rebuilding and restoring of public works destroyed or damaged by the floods of March and April, 1913, and shall exercise and perform such powers and duties jointly with such director." In the section relating to counties the same words are used except that "county commissioners" are substituted for "director of public service."

The state commission acts in an advisory manner in flood reconstruction work. Local commissions can be removed by the appointing authority or they can voluntarily retire. Voters by petition can force an election at which local commissions can be retired or continued. None of the commissioners receive any pay for their work. Thus far the commissions consist of well known business and professional men in their respective communities.

## How to Keep a Clean City

In connection with the annual arbor day program in the public schools, Mayor James B. Estee, of Montpelier, Vt., announced a "clean-up day." The arbor day exercises were held in the morning and the children were given the remainder of the day if they would put in at least two hours time in cleaning up the street and grounds about their homes, especially back yards and dumps. The "City Guards" is an organization with 1,900 children among its membership, who have subscribed to the following pledge:

"I believe in a clean city, clean house, clean streets, clean citizens and clean government. Because I believe in a clean city, I will be a "City Guard." I will obey the city's laws; I will keep my home surroundings clean; I will help to keep the streets clean; I will use clean speech; I will be helpful to others and courteous to strangers; and I will play the "clean game." I will be a loyal citizen of Montpelier and I will never bring disgrace upon her by any act of disloyalty, dishonesty or cowardice."

## City to Rebate Water Bills for Parkways

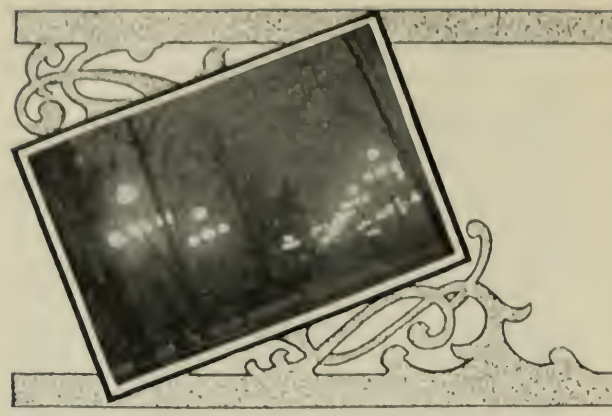
In order to encourage the citizens to keep the parkways in good condition during the summer, the city of Ontario, California, is planning to give a rebate on water bills to cover the cost of watering the strip next to the curb. This will be accomplished by taking a certain test strip of sod and keeping it well watered so that the amount of water for a square foot of lawn can be estimated. The property owners who keep their parkways green will receive a rebate on their water bill in proportion to the number of square feet of parkway under their care. This is a step in the right direction, as when water meters are installed there is a tendency to neglect the parkways by too economical householders, while the neglect of that part of the street is a detriment to the appearance of the city. In fact under the former arrangement, the careful householder who takes the trouble to care for his parkway is penalized by water rates that in the course of a year amount to the same thing as a stiff fine, while the untidy man who lets his strip of lawn die during the summer is rewarded by a lower water rate. On the face of it, such an arrangement is absurd and the Ontario plan is worth consideration by all promoters of the city beautiful idea.

## Cleveland Municipal Heating Plant

A resolution has been introduced in the Cleveland, O., city council defining the territory for extensions of steam pipes from the city's Fairmount heating plant west in Euclid and Cedar avenues to 88th and 89th streets and in the adjacent territory. The pipe will cost $50,000 and the total estimated cost is $100,000. Careful record is kept of the operation of the station to secure data on which to base plans for a large plant for the downtown district.

## Under-Water Coal Storage in Concrete Bins.

It is rather strange that cement, which is one of the cheapest of all commercial commodities should be used extensively for the protection of the next cheapest commodity—coal. Several thousand barrels of Universal Portland cement were used by the Indianapolis Light & Heat Co., in the construction of a huge box 100 by 300 feet and 54 feet deep in which to store over 30,000 tons of coal. This is a somewhat new development but it has been found that coal loses considerable in heating value when stored in the open and furthermore that spontaneous combustion is almost impossible to prevent when coal is stored in large piles. The storage in concrete pits makes it possible to keep the coal under water from the time it is received at the plant until ready for use, and while it adds somewhat to the expense of operation yet it is insurance against loss.



# STREET LIGHTING

## Seattle, Wash., Municipal Light & Power Plant

*By J. D. Ross, Fellow Am. Inst. Elec. Eng's., Superintendent of Lighting.*

The fight against municipal ownership of lighting plants has been a strong and persistent fight, more or less organized and not lacking in finances. On the other hand municipalities have no funds to offset these attacks nor is there any personal gain or other incentive, such as naturally characterizes private ownership. The result is that these attacks are rarely defended and a considerable number of people believe them.

The Seattle Lighting Department has taken the attitude that energetic work and consequent success will do more to offset unjust criticism than all the answers to critics that it could have written. The experience gained during nine years of the growth of the plant shows that a municipal plant has the same chances as a private concern. If the management is poor or the machinery ill chosen and inefficient, the plant is a failure. If the management is good and the machinery and equipment of the best, the plant is a success.

### Competition With Companies

The Seattle plant is actively competing with two water power companies having three steam auxiliaries supplying a combined output of about 50,000 kw. in water power and 17,000 kw. in steam power. These companies, with several others in the Northwest, have lately merged, thereby becoming still stronger, claiming a combined capital of $50,000,000. The city plant has been able to compete with these concerns and has carried a considerable part of its competitor's load in times of accident and coal shortage, ranging from 1,000 to 5,000 h.p. during the periods from January 18th to 25th, 1907; March 12th to 19th; October 17th to 30th, November 22d, 1907, and September 22d to 26th, 1910, inclusive. The city plant was given a considerable part of its load during accident from flood by its competitors from November 19th to December 10th, 1911, inclusive.

Construction on our municipal plant was begun in April, 1902, and the first current was delivered in Seattle January 10, 1905.

### Finances of Plant

All of the municipal light and power plant bonds are general lien bonds, and require that there be a tax levied annually to pay the interest thereon, and in making up the city's annual tax levy this item is always included, also the tax levy of 1906 included an additional item for the benefit of the plant.

In making up the annual budget each year there is included in the tax levy an item covering the annual interest on the municipal light and power plant bonds. Against this item on the credit side of the budget is entered an item equal to the total annual interest on the municipal light and power plant bonds as a refund from the light fund, thus making a reduction in the total levy equal to the total municipal light and power plant bond and interest charges. The interest on the bonds issued to build the plant is all refunded to the general fund from the earnings of the plant, and the taxpayer is in no way burdened to support the plant. A cluster, or ornamental system of lighting has been installed on the main business streets and on several streets. The cost of this system has been paid by the owners of property abutting upon these streets.

As the property owners invested the cost of the cluster lighting system, there is no interest chargeable against said cost, nor is any interest paid on said investment. The owners figure that the cluster system is a permanent improvement, and add the cost to the capitalized valuation of their property.

### Charges for Service

The municipal light and power plant charges the general fund $54.00 per year per arc of 6.6 amperes, and $13.80 per year per incandescent of 40 candle power. At the time of taking over the street

JAMES DELMAGE ROSS, *is an electrical engineer, a fellow of the American Institute of Electrical Engineers, who has been interested in electrical science, design and construction most of the time since his graduation from school in Chatham, Ont., in 1890, in which place he was born. He went west in 1898, became assistant city engineer of Seattle in 1903 and later city electrical engineer and as such designed the plant which he describes, one of the largest and most successful municipal plants in the world. Since February, 1911, he has had the title of superintendent of lighting and is a member of the board of public works. He has the rather unusual pleasure of being responsible for the operation and development of the plant which he designed and built.*

*Attacks have been made by the opponents of municipal ownership upon the results of the operation of the plant and it has been termed by them a municipal ownership failure but the figures and facts which Mr. Ross gives in this article clearly show that such statements are misrepresentations if not worse.*

lighting by the municipal light and power plant, February 1, 1905, the city was paying the Seattle Electric Company $66.00 per year per 6.6-ampere arc, and $15.00 per year per 30-c.p. incandescent. At the time the City of Ballard was annexed to the City of Seattle, in June, 1907, that city was paying the Seattle Electric Company $66.00 per year per 6.6-ampere arc, and $13.20 per year per 20-c.p. incandescent. These prices were paid the Seattle Electric Company until the expiration of their contract with the City of Ballard, on August 31, 1910.

At the time of the annexation of Georgetown by the City of Seattle, April, 1910, the Seattle Electric Company had a contract with that city at $64.80 per 6.6-ampere arc per year. The City of Seattle paid the Seattle Electric Company at this rate per arc, and continued to do so until the expiration of the company's contract with Georgetown, in October, 1912.

At the time of the annexation of South Park, that suburb was paying the Seattle Electric Company for street lighting $21.00 per year per lamp for the 32-c.p. carbon lamp. The City of Seattle paid this rate to the company under the South Park contract, which expired in December, 1911. The municipal light and power plant charges on all 32-c.p. carbon lamps used in street lighting $9.60 per year per lamp.

At the time of taking over the street lighting system by the municipal light and power plant, the street lighting system of Seattle consisted of 213 arcs and 1,891 incandescents. The street lighting system now consists of 929 arcs and 5,876 incandescents, 100 32-c.p. carbon lamps, and 1,168 5-light, 377 3-light and 137 1-light poles in the cluster light system.

The old rate for residence lighting charged by the municipal light and power plant was as follows:

8½ for the first 20 kw. hr.
7½ for the second 20 kw. hr.
6½ for the third 20 kw. hr.
4½ for all over 60 kw. hr.

with a minimum charge of $1.00 per month.

After July 1, 1912, the rates were reduced to 6c for the first 60 kw. hr. and 4c for all over 60 kw. hr., with a 50c minimum. Rate for current for electrical appliances in the home, 3c per kw. hr. minimum charge, $1.00 per month.

The minimum charge per month of the municipal light and power plant has never been more than $1.00 for residence lighting.

In 1902 and previously consumers of electric current for residence lighting were paying 20c per kw. hr. When the agitation for a municipal plant began and it looked as if one would be constructed, the rate was dropped to 12c per kw. hr. A reduction of 40 per cent. directly due to the municipal plant.

After the municipal light and power plant began making contracts for residence lighting, in September, 1905, the Seattle Electric Company again lowered its rates, as follows:

9½c per kw. hr. for the first 20 kw. hr.
8½c per kw. hr. for the second 20 kw. hr.
7½c per kw. hr. for the third 20 kw. hr.
5c per kw. hr. for all over 60 kw. hr.

A decrease of 10 per cent. in rates, due directly to the municipal light and power plant.

The competition of the municipal light and power plant has forced the companies to make three reductions in their rates since 1902. The first of 40 per cent., the second of 16 2-/3 per cent., the third of 10 per cent.

The municipal light and power plant was constructed by the city engineer, an official who had been in that position for over seventeen years at the time he began constructing the plant, and is still city engineer. After its construction the operation and extension of the plant was turned over to the superintendent of the water and lighting department. This official had held his position about eleven years at the time he began the operation of the municipal light and power plant, and for five years he remained in charge. This official is still superintendent of the water department.

### Establishment of Lighting Department

The growth of the water and lighting departments made it necessary to separate them, which was done in April, 1910. The present superintendent had active charge of the plant during its construction period as assistant city engineer, and remained with the plant as chief electrical engineer until he was appointed superintendent of lighting. This official has been with the plant from the beginning, nearly nine years. All the men holding positions of responsibility and authority have been with the plant practically from its beginning. All employes of the municipal light and power plant are under civil service rule, and are debarred from taking part in politics under pain of dismissal. The municipal light and power plant is not run by politicians and for political purposes at this time, nor has it been at any time since its inception.

### Source of Power

Cedar Lake, the source of power for the Seattle municipal light and power plant, familiarly known as the city light plant, is situated in the Cascade Mountains, southeast of Seattle and at a distance of about 43 miles. The normal lake level lies at an elevation of 1,530 feet. The lake is approximately 1.91 square miles in area and drains a watershed of 79 square miles. The mountains hold a considerable amount of their snow during the early summer and fall, and so give a more continuous flow of water thruout the year. The rainfall is enormous over this district, amounting to an average of 111.01 inches per annum at the lake level, with a greater precipitation at high elevations, due to the greater chilling of the clouds in passing over the mountains.

The lake discharges at its northerly end into Cedar River, a swift mountain stream which, after tumbling thru rapids and cascades, between rocky walls for three and one-half miles, reaches a valley over 600 feet below the lake level. At this point the generating station of the city light plant is situated.

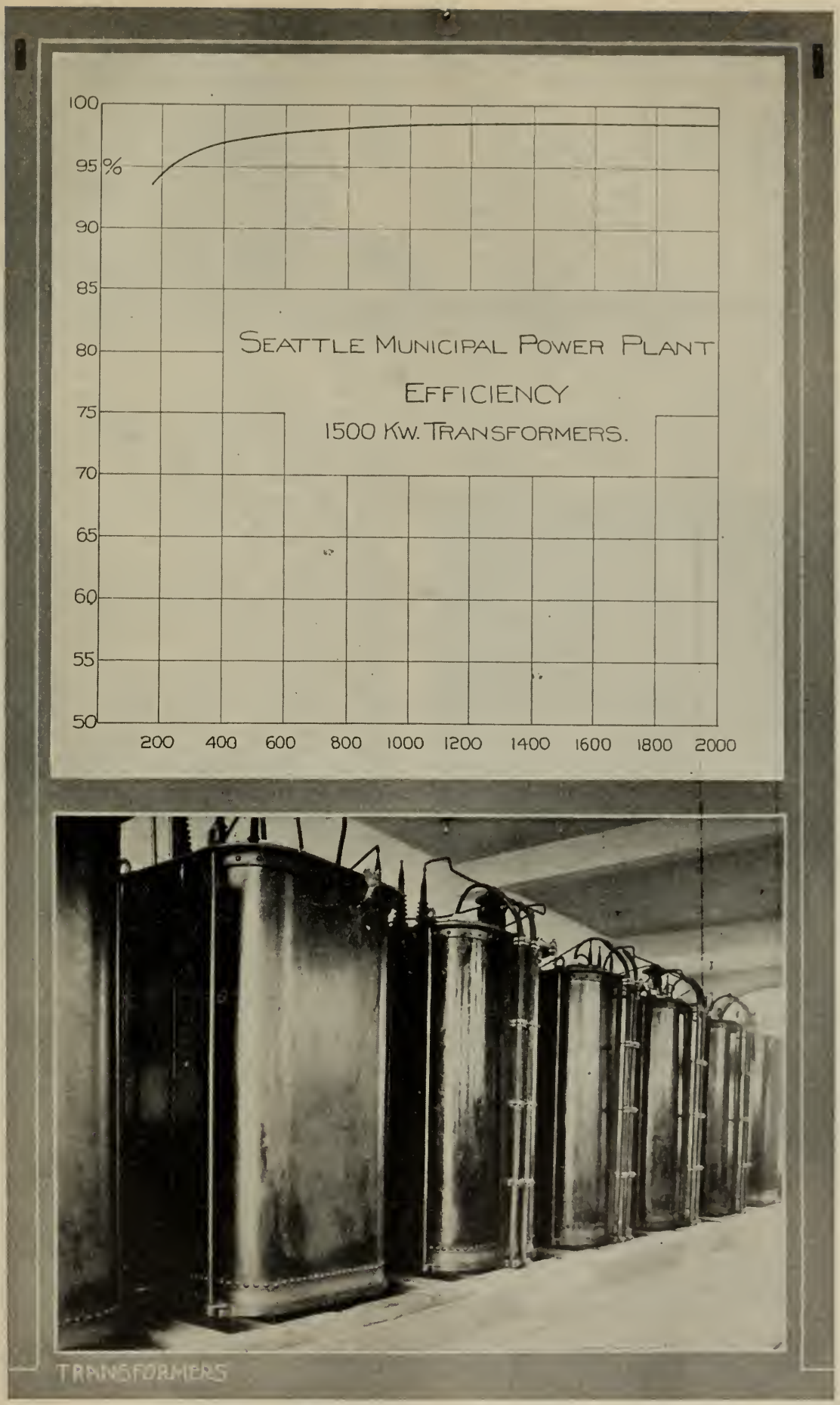
In order to supply power for the generating station, a rock-filled timber dam 250 feet across was constructed in the river about three-quarters of a mile from Cedar Lake, raising the original lake level 18 feet. This dam impounds sufficient water to operate the plant with its present needs for 90 days in dry weather, without considering the natural inflow during this time.

From the control gates at the dam two pipes, one 48-inch and one 68-inch are laid to carry the water to the plant below. These pipes are built of wood staves banded with steel for a distance of approximately 15,400 feet; the remainder of the distance, about 1,000 feet, is constructed of riveted steel pipe. Both pipes are almost entirely underground, covered with 18 inches of earth. The combined maximum capacity of these two pipes is 14,000 horse power.

### The Equipment

The power house contains generators of a total maximum capacity of 18,000 horse power, all of which can be utilized by providing an additional pipe and some additional storage. To complete the plant and develop its ultimate capacity it is necessary to impound the entire run-off of the watershed. To this end a concrete dam is being constructed at a point in Cedar River two and one-quarter miles below the lake. This dam will be 720 feet long and 215 feet high and will raise the original lake level 75 feet, or an additional 58 feet above the crest of the present dam, and will increase the size of Cedar Lake to 5.23 square miles. The total power available after this work is done will be 14,950 kilowatts continuous every hour of the year. The average load for the year in the city plant will probably be about 40 per cent. of the maximum load, and consequently the machinery which can be operated from the new reservoir will be not less than 37,400 kilowatts or 50,000 horse power, measured on the switchboard at Cedar Falls Station. This is a very conservative estimate.

Cedar River is also the source of the city water supply and the new dam will greatly increase the capacity of the water system as well as of the lighting system. The water is remarkably pure and clear, and in order to maintain the best




FORT WAYNE STEP DOWN TRANSFORMERS *in Seattle City Sub-Station.*

sanitary conditions an enormous amount of timber is being cut and cleared off from the area to be overflowed by the lake when the new dam is completed.

The city power plant is situated at Cedar Falls, a town on the Chicago, Milwaukee and Puget Sound Railway.

The generators at the power house, four in number, are direct connected to water wheels, two of which are turbines and two impulse wheels, the whole being set on solid bed rock. The wheels discharge into Cedar River. The city has provided four modern houses for its employes at the power station, and two more are in process of building. Sanitation is carefully observed and all sewage is carried away from Cedar River to the Snoqualmie watershed.

The station is equipped with nine Fort Wayne transformers arranged in concrete cells in three banks, one bank to each cell. Each bank has a normal capacity of 4,500 kw. at 35 degrees C. temperature rise. Those transformers step the voltage from 2,300 to 60,000 volts three-phase star-connected. All high tension wiring is done on iron pipe framework using metal pins. The neutral of the star-connection is grounded.

These transformers were carefully tested and the all-day efficiencies computed. The maximum efficiency at full load showed 98.6 per cent. and the all-day efficiency during 1911 showed 96.1. All these transformers were in circuit continually to keep them in good condition and their core losses were continuous. They are insulated with solid ⅛-inch micanite partitions and molded mica channels on coils next to the iron core. The result of this extra insulation is that the operation of these transformers since their installation has been under all conditions all that could be desired. Eight exactly similar transformers are installed at the substation, to step the voltage down from 60,000 to 2,500 volts.

Current is generated at the power house at 2,300 volts, and stepped up to 60,000 volts for transmission to Seattle. Two entirely separate lines are used for added security to the service. These lines are each 38.7 miles in length and come over private right of way for the entire distance. All timber that could fall and touch the lines has been cut. A line patrolman is stationed at Landsberg and one at Renton. These lines enter the Seattle substation at Seventh Avenue and Yesler Way, where the voltage is stepped down to 7,500 and 2,500 for city distribution.

The distributing system includes 17,600 poles and 3,661 miles of wire operating in connection with 1,288 transformers, supplying approximately 26,000 customers, besides a street system consisting of 712 arc lamps, 217 350-c.p. and 5,876 40-c.p. series tungsten lamps lighting 643 miles of street, and 1,682 ornamental iron cluster light poles lighting 25 miles of street. Of these poles 1,168 carry five globes, 377 carry three globes, and 137 carry one globe each.

## Annual Report of the General Asphalt Company

On a total volume of business during 1912 of $14,995,323, the annual report of the General Asphalt Company shows net earnings of $1,343,698. After deductions to cover maintenance costs above the reserve for this purpose, there was left a net gain to surplus of $1,120,924, as compared with $818,785 for 1911. The net gain to surplus amounts to 8.5 per cent. on the preferred stock. After paying the full 5 per cent. dividend on the $657,000 of preferred, there was earned a balance of 4.7 per cent. on the common stock.

Reduced to a basis of crude asphalt the tonnage sold and consumed amounted to 300,403 tons in 1912 as compared with 265,677 tons in 1911.

The continued development of the company's business along the lines of a manufacturing and supply company, rather than a contracting company, is shown by the fact that the sales of asphalt reached a total of $9,009,309, or more than twice the amount of the paving account and substantially larger than all the other accounts put together.

During 1912 the company constructed 1,106,287 square yards of sheet asphalt pavement, exclusive of the yardage constructed with its materials by other contractors. The latter, on the basis of asphalt tonnage delivered, constructed not less than 6,500,000 square yards, or 410 miles of streets of an average width of 27 feet. The tonnage of road asphalt increased from 20,479 tons in 1911 to 31,289 tons in 1912. Trinidad liquid asphalt for road purposes, as distinguished from street paving, increased from 4,653 tons in 1911 to 18,902 tons in 1912.

Reporting the progress of its old development in Trinidad, the report shows that the production for the year ending January 31, 1913, was 247,208 barrels as against a production of 141,233 barrels in the corresponding year previous. From February 1st the production has averaged 875 barrels a day as against an average of 675 in the year ending January 31st. The company reports the conclusion of arrangements for the development of oil in Venezuela, where explorations wells have already begun to produce.

# PERSONAL

## E. A. Kingsley

E. A. Kingsley, the first appointee to the office of State Highway Engineer of Arkansas is a graduate of Purdue University with some twenty years experience in the practice of engineering. He began in the engineering corps of Indianapolis and then went into railroad service with the Great Northern, Colorado Fuel and Iron Co., and Chicago Rock Island and Pacific, being located at Little Rock for the latter road. From this employment he was taken by Mayor Lenon and made city engineer of Little Rock and superintendent of public works, in which capacity he acted from 1904 to 1911. For the past two years he has been in private practice and has also been highway engineer for Pulaski county, building several roads as such, among them the Twelfth, Nineteenth and Arch street pikes.

Mr. Kingsley's reputation as an engineer, especially as a municipal engineer and paving expert, extends beyond the city, county and state in which he lives and has worked. Last year he was president of the American Society of Municipal Improvements, the oldest and the leading association of municipal officials and devoted particularly to municipal improvements. He has also taken an active part in the Society for Standardizing Paving Specifications and has done excellent work on the committees of that organization. He is an associate member of the American Society of Civil Engineers, and affiliated with the American Road Builders and American Highway Associations, the Arkansas Society of Engineers and other local organizations.

Mr. Kingsley is a man of ability and energy and will undoubtedly give the state excellent service in its new department.

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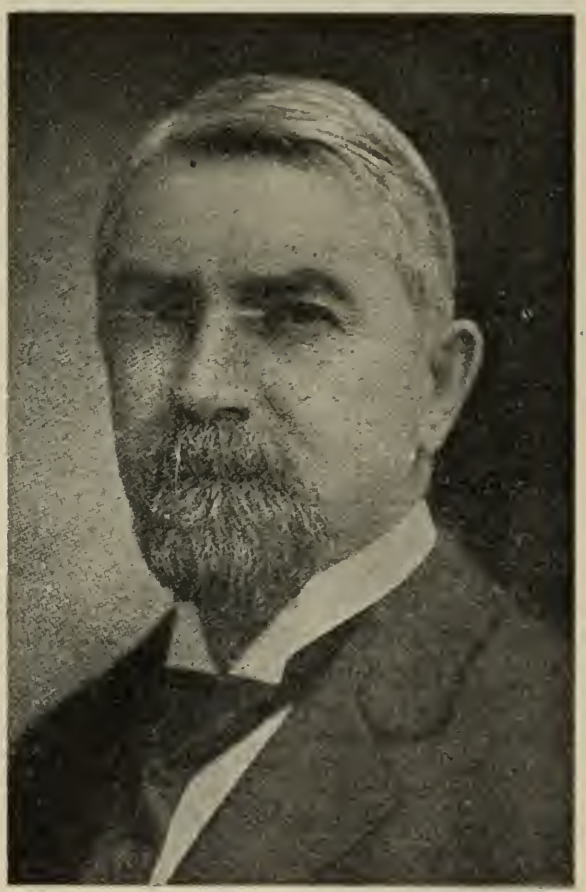
## Horace G. Burt

Horace G. Burt, late chief engineer of the Chicago Association of Commerce on smoke abatement and electrification of terminals was an engineer and railroad manager of national prominence. After his graduation from the University of Michigan in 1873 he held engineering positions on various railroads, becoming



HORACE G. BURT.

chief engineer of the Chicago & Northwestern railroad in 1881 and later division superintendent, general manager of two allied roads, third vice-president, and for six years, from 1898, president of the Union Pacific railroad. He was later receiver for the Chicago Great Western railroad and for the past three or four years has been in practice as a consulting engineer.

He was selected about a year ago for the position he held at the time of his death, on account of his special knowledge of railroad terminal problems and his committee has been notable for the value of the preliminary work it has done in the study of the very important problem which has been set for it.

His funeral at his birthplace, Terre Haute, Ind., was attended by many railroad presidents, chief engineers and officials of less degree.

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## Improvement of Michigan Avenue Across the Chicago River

A very important improvement of Michigan Avenue, Chicago, where it crosses the Chicago river, reached on May 20, 1913, the stage of public hearing on the resolution ordering it. The whole improvement, according to the estimates of C. D. Hill, the engineer of the board of local improvements will cost no less than $2,298,247, not including land required, but those who know the present narrow, crooked, intersected, and congested throat which the improvement covers will recognize that it is worth all it costs.

The total length of the improvement is approximately 4,500 feet. For the greater part of the distance it comprises two thorofares, one above the other. What is termed the upper level extends the whole distance named, which is from Randolph street south of the Chicago river to East Chicago avenue on the north of the river. The lower level street begins at Lake street, one block north of Randolph and extends to Indiana street, three blocks north of the river. Michigan avenue is widened on the east side south of the river, the improvement takes some private property just north of the river and Lincoln parkway is widened on the west side, so that the revised thorofare will be straight except for the slight turns which take place in the wide plazas at the two ends of the bridge across the river. The width south of the plaza at the river is 127.5 feet and north of the plaza on the north side of the river is 141 feet.

The bridge across the river is to be a double-decked bascule bridge with clear span of 220 feet, the upper deck to have two 27-foot roadways and two 15-foot sidewalks and is 90 feet wide over all. The lower deck has two 18-foot roadways and two 5-foot sidewalks and a width of 60 feet over all.

The upper level provides for the thru traffic, particularly the boulevard traffic between the north and south sides, and the lower level provides for the business traffic across the river on the present level of these business streets. Where there are the two levels, the upper thorofare is supported on an elevated steel and concrete structure. The approach to this elevation rises gradually at the south end from Randolph street to Lake street and on the north end from Ontario street to Ohio street. An approach to the upper level is provided on Lake street from Wabash avenue, and two approaches are provided on Ohio street, from Rush street on the west and St. Clair street on the east.

Lake street east of the improvement, and the two Water streets, Michigan, Illinois and Indiana streets connect with the lower level thorofare on both sides of it; also River street from the west. Concrete stairways for foot passengers connect the two levels at each of the streets named.

South of the river plaza the upper roadway is 75 feet wide, the lower roadway 41 feet 2 inches. The upper sidewalks are 30.5 feet wide and the lower sidewalks from 3 feet 10 inches to 25 feet in various places according to the demands of the changes in street lines and the elevated structure.

North of the river plaza the upper roadway is 80 feet wide and the lower about 45 feet wide. The upper sidewalks are 30.5 feet wide and the lower sidewalks about 9 feet 4 inches.

Most of the private property taken for the improvement is to provide for the plazas at the two ends of the bridge across the river. Each of them extends about 300 feet along the river, about half on each side of the center line, which is about 125 feet each side of the outer lines of the bridge or 100 feet outside the lines of the boulevard. This gives opportunity for a material widening of the roadway for use of vehicles waiting for the closing of the open bascule, for isles of safety, wide paved walks, ornamental lighting and other methods of dignifying and beautifying the approaches to the bridge, which will be one of the most notable bridges in the city.

The plazas on the lower level contain the rows of columns supporting the upper level and can have no ornamental features. They contain the houses for the operating mechanism of the bridge and are laid out with convenient roadways and sidewalks, for which there is ample room.

Architectural piers and architraves of terra cotta and balustrades of Bedford limestone are provided for at each street intersection with the double roadway section, that the appearance of the structure where seen from the sides may be in conformity with its beauty as seen from above. Granite piers are provided in addition at River street and East North Water street.

The plan for electric lighting of the roadway and plazas promises very handsome and effective groupings which will add their own beauty to the beauties of

the structure which they will reveal.

The plans are very complete in their provisions for all parts of the structure, and for connections with existing streets and structures and offer a very satisfactory solution for a large problem which has been troubling the city of Chicago for many years. Chief Engineer Hill and his associates are to be highly commended for the ability and industry which they have displayed.

The estimate of the cost is made in great detail and the summary for the various sections shows their relative importance from this point of view.

SUMMARY OF ESTIMATES.

| | |
|---|---|
| Superstructure of bridge..... | $412,030 |
| Machinery for bridge ..... | 84,620 |
| Substructure for bridge ..... | 298,660 |
| Bridge houses ..... | 61,600 |
| Abutment walls ..... | 124,055 |
| Total for river crossing..... | $980,965 |
| Elevated structure ..... | $808,729 |
| Walls and excavations..... | 307,370 |
| Pavements ..... | 154,030 |
| Lighting ..... | 47,153 |
| Total cost without land.....$2,298,247 | |

## Personal Notes

H. D. Forneri, has been reappointed city engineer of Eugene, Ore.

Dudley D. Britt has been appointed city engineer of Clarksburg, W. Va.

Albert Philips has been elected chief of fire department of Palataka, Fla.

Martin A. Rooney has been appointed smoke inspector of Nashville, Tenn.

C. F. Crabtree has been reappointed city electrician of Fort Worth, Texas.

Floyd Blevins, has been elected chief of the fire department of Globe, Ariz.

Z. E. Sevison, county engineer has also been appointed city engineer for Laramie, Wyo.

Chas. Knutter has been appointed city engineer of Ely, Minn.

A. M. Lund has been appointed city engineer of New Decatur, Ala.

John Daniels has been appointed city engineer of Dubuque, Iowa.

P. J. Lucey, has been appointed engineer of the waterworks of Holyoke, Mass.

Arthur Wadham has been appointed city engineer of Hillyard, Wash.

G. W. Heinmiller, county surveyor has been appointed city engineer of Carrington, North Dakota.

A. H. Kindrick has been appointed city engineer of McAlester, Okla.

L. M. Roesseler has been appointed city engineer of Fremont, Neb.

E. G. Bradbury and F. A. Barbour, consulting engineers, of Columbus, Ohio, and Boston, Mass., respectively, have been retained as consulting engineers on a proposed river improvement thru Tiffin, Ohio, to lessen the damage from recurring floods.

John W. Alvord, consulting engineer, of Chicago, has been retained by the city of Columbus, Ohio, to furnish plans for the protection of the city against floods.

Edwin Thacher has withdrawn from the Concrete Steel Engineering Co., and opened offices as a consulting engineer in bridge construction, particularly reinforced concrete in the Park Row building, New York city.

The Morgan Engineering Company, of Memphis, Tenn., composed of Messrs. Arthur E. Morgan and L. L. Hidinger, have been selected to make plans for flood relief at Dayton, Ohio.

Prof. Harry O. Garman, associate professor of civil engineering at Purdue University, has been appointed chief of the engineering staff of the Indiana Public Service Commission.

Louis C. Kelsey, civil and hydraulic engineer, of Portland, Ore., will design and construct a waterworks system for Amity, Ore.

Horace G. Burt, who has for several years been president of the Union Pacific Railroad Company, has done some of his best work for the committee of the Chicago Association of Commerce on smoke abatement and electrification of railway terminals of which he has been serving as chief engineer. His recent death will not stop the work for he had organized it so efficiently that it will proceed without delay.

B. F. Affleck, the general sales agent of the Universal Portland Cement Co., became associated with the company in 1900 when it had barely started in business. Then he had 40,000 barrels of cement to sell in a year; now he has 12,000,000 barrels a year to dispose of; and he could sell more if he had it. His success he attributes to his determination to know all he could about the material and what could be done with it, and to put this knowledge at the service of his customers, and his advancement to his constant effort to give his company the full value of his services, and to make that several times what he received for them, if possible.

Charles H. Pindell, assistant to the president of Warren Brothers Company, died suddenly on May 13, at the age of 32. For several years Mr. Pindell has attended many Good Roads Conventions at which he made many friends.

Col. Frank W. Buffum, of Louisiana, Mo., has been appointed State Highway Commissioner and W. S. Hawkins, deputy commissioner and ex-officio State Highway Engineer of Missouri.

Curtis Hill, recently state highway

engineer of Missouri has been appointed city engineer of Kansas City, Mo.

Mr. Frank T. Townsend, Assoc. M. Am. Soc. C. E., formerely First Assistant Engineer of the New York State Highway Department has accepted the position of Assistant Engineer in the inspection department of the Dunn Wire-Cut-Lug Brick Company, of Conneaut, Ohio. The business of the Dunn Wire-Cut-Lug Brick Company has increased to such an extent as to make it necessary to enlarge this department. Mr. Townsend is a graduate of Rensselaer Polytechnic Institute and has been with the New York State Highway Department for the past five years, principally on brick construction.

## Technical Associations

The 45th annual convention of the American Society of Civil Engineers will be held in Ottawa, Can., June 17-20. The business meeting and president's address occupy one session, an illustrated lecture on Canadian engineering subjects another and receptions, garden party, and trips about the city and to engineering points of interest occupy the remainder of the time. Chas. Warren Hunt, secretary, New York.

The Seventh Chicago Cement Show will be held in the Coliseum, February 12 to 21, 1914, which covers a period of eight days and nine nights, not including Sunday, February 15. The National Association of Cement Users will hold their Tenth Annual Convention in conjunction with the show.

At the meeting of the Municipal Engineers of New York city, held May 28, Frederick W. Koop presented a paper on "Precise Leveling in New York City."

To the 4th International Congress on School Hygiene, to be held in Buffalo, N. Y., August 25-30 are invited delegates from towns, cities and states, as directly interested in its objects. Thos. A. Storey, secretary-general, College of the City of New York, New York City.

The Panama Canal was the subject of the May meting of the Colorado Association of Members Am. Soc. C. E.

The 8th annual meeting of the Federation of Trade Press Associations will be held in New York September 18-20. This association has a total membership of 236, representing over 75 different trades, industries and professions. An exceedingly interesting program of practical discussions is being arranged by W. H. Ukers, the chairman of the committee. H. M. Swetland, president, New York.

Special trains for the American Water Works Convention, to be held in Minneapolis June 23-27, will leave New York June 21 at 10.50 a. m., and Chicago June 22, both morning and evening.

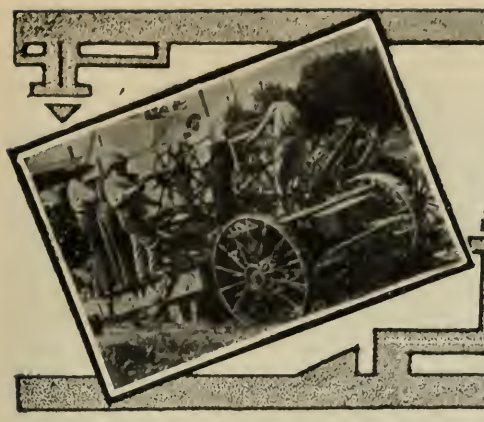
The National Conference on City Planning at Chicago May 5 and 7 was devoted to the discussion of such subjects as the city planning commission, opened by Mayor W. A. McGee of Pittsburgh; the land-tax system for public improvements, opened by Geo. E. Kessler, who described the system in use in Kansas City, which has been followed more or less closely by others; and the effect of transportation facilities on city planning, opened by Milo R. Maltbie, of the New York City Public Service Commission. The conference was of great practical value on account of the presence of so many experts in this field.

## Technical Schools

"Entropy-Temperature and Transmission Diagrams for Air," by Professor C. R. Richards has just been issued as Bulletin No. 63 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the theory and use of three graphical charts, by the aid of which all problems pertaining to the compression, expansion, and transmission of compressed air may be solved with a minimum of labor and with a degree of accuracy which is satisfactory to engineering work.

The dedication of the new transportation building and locomotive and mining laboratories, May 8 and 9, at the University of Illinois was made the occasion of conferences on railway and mining problems with addresses by many men of prominence in these lines.

"Tests of Reinforced Concrete Buildings Under Load," by Arthur N. Talbot and Willis A. Slater, has just been issued as Bulletin No. 64 of the Engineering Experiment Station of the University of Illinois. The design and erection of safe structures of reinforced concrete is rendered more certain by the results of experimental investigation of the stresses which are produced in building under load. Within the last few years improved apparatus and methods have been developed at the University of Illinois which have made possible the accurate measurement of stresses in the beams, columns, and floor-slabs of reinforced concrete structures. This bulletin gives the results of tests made on the floors of three large reinforced concrete buildings. It also presents a discussion of the apparatus and the testing methods used. It will be found useful to architects and structural engineers.



# MACHINERY AND SUPPLIES

## A New Universal Portland Cement Plant

The Universal Portland Cement Company, a subsidiary of the United States Steel Corporation, has started work on the construction of plant No. 7, at Duluth, Minn.

This plant will cost about $1,700,000, and will have an output of 1,400,000 barrels of Universal Portland Cement per annum.

The plant will be electrically operated thruout, requiring about 5,000 h. p.

Mr. Edward M. Hagar, president, states that work will be pushed as rapidly as possible, and it is expected that the plant will be in operation in 1914. With its present plants at Chicago and Pittsburgh, this plant will give the company a total output of 45,000 barrels a day, or 13,500,000 a year.

The shipments of Universal Portland Cement in 1912, 10,047,499 barrels, exceeded those of any cement company in the world.

It is interesting to note the growth of this company, as well as the percentage of its output to the total American production, as shown by the following table:

| Year. | Production Portland Cement of U. S. Barrels. | Production Universal Portland Cement. Barrels. | Pct. of Universal to Total Amer. |
|---|---|---|---|
| 1900.... | 8,482,020 | 32,443 | .39 |
| 1901.... | 10,711,225 | 164,316 | 1.29 |
| 1902.... | 17,230,644 | 318,710 | 1.85 |
| 1903.... | 22,342,973 | 462,930 | 2.08 |
| 1904.... | 26,505,881 | 473,294 | 1.78 |
| 1905.... | 35,264,812 | 1,735,343 | 4.92 |
| 1906.... | 46,463,424 | 2,076,000 | 4.55 |
| 1907.... | 48,785,390 | 2,129,000 | 4.36 |
| 1908.... | 51,072,612 | 4,535,000 | 8.89 |
| 1909.... | 64,991,431 | 5,786,000 | 8.92 |
| 1910.... | 76,549,951 | 7,001,500 | 9.14 |
| 1911.... | 78,528,637 | 7,737,500 | 9.85 |
| 1912.... | 81,941,998 | 10,114,500 | 12.34 |

## Good Roads for Berrien County, Michigan

That the interest in permanent roads is increasing is evident by reports which come from all parts of the country. One of the most recent is from Berrien county, Mich., where the board of commissioners voted on and authorized the issuance of $500,000 worth of bonds, the money to be used in building good roads through the country.

Two years ago the county adopted the county road system, but found this method too slow for its purpose and consequently has just accepted the bond issue plan as a more expeditious means of accomplishing the desired end. The state aid fund will amount to about $100,000, which will bring the total to be used on good roads to $600,000. This will probably be extended over a period of five years, and provision for retiring the bonds will be made from the regular tax levy extending over a term of twenty years. The members of the county board are studying the various forms of permanent road construction and they are reported to be favorable to the use of concrete. Splendid results in building concrete roads have been obtained in various localities, notably in Wayne county, (Detroit), Mich. The concrete country roads around Detroit have been visited by scores of delegations of interested road builders from all over the country. Concrete roads are already playing an important part as consumers cement. In Wayne county, Mich., 100,000 barrels of Universal Portland cement were used in 1912 and an additional 100,000 barrels of the same brand will be used in 1913.

## A Fire Alarm System Using the Telephone Wires

One constant question about a district telegraph system of sending in fire alarms is as to the working of the circuits. Testing them frequently is expensive and troublesome, and if they are not tested they may be out of order at the time they are needed most. The Denio system uses the telephone wires, and they are tested every time the telephone is used. The value of the system is recognized by telephone companies as a business getter, and as a by-product of the telephone system, giving

a revenue with little or no additional expense.

In brief, the system consists, in a residence, of a fire alarm box with a glass cover, which is broken by a hammer attached to the box, and a button is pushed to send in the alarm. This cuts the telephone out during the sending of the alarm and gives a fire signal to the telephone operator at the central station, who connects the line to the register circuit, which records the box number at fire headquarters and any other desired places on the circuit, and rings any desired bells. The attendant at fire headquarters consults his running board, finds the location of the box and orders out the proper fire-fighting apparatus.

The signal is repeated sixteen rounds in one minute and forty-five seconds, altho the call may be answered in from three to six seconds, so that no chance is taken of failure to get the box number on bell or register.

The central telephone office has provisions for putting all telephone lines with fire alarms on special sections of the switchboard, with specially trained operators and with extra night alarm signals, when the number of telephone operators is less than by day. Non-interference of two or more fire alarms at the same time is also provided for if there is more than one wire to fire headquarters.

The system can be installed for automatic and for magneto telephone lines as well as the regular manual systems, by devices which have been invented, and is even easier to handle with the magneto than with other systems.

Street boxes may be used.

In factories, warehouses and the like, where it is desired to have facilities for sending in alarms from various parts of the buildings, a master box is installed and the push-button boxes set it in operation. Besides sending in the regular alarm, it can be fitted to work an annunciator to tell which box on which floor the alarm comes from. This may be outside, so that the fire department, when it arrives, will lose no time searching for the fire. The master box may also set bells or other alarms to ringing. Thermostats and connections to sprinkler heads can also be made so that the alarms will be sent out automatically.

The factory system of wiring can be tested independently of the telephone line to insure its constant working, but the attachment of the local alarms to the telephone battery insures its regular condition.

This system is now in control of the American Telephone Fire Alarm Company, 10 La Salle street, Chicago, Ill., successors to the Denio General Electric Company, and they can give full details and send booklets giving full explanations and illustrations.

## Two Types of Reinforced Concrete Pavement

The city of Oakland, Cal., solved the problem of how to construct pavements on filled ground by selecting and constructing a reinforced concrete pavement on the street parallel to the United States bulkhead and estuary. The specification called for Triangle Mesh reinforcement, style No. 28, as manufactured by the American Steel and Wire Company, 25,025 square feet being used. The following extract from the magazine published by real estate interests, together with the accompanying photographs, will clearly show the bad conditions of the foundation over which this reinforced concrete pavement was placed.

"One of the most difficult engineering problems that has presented itself to the Board of Public Works has been the construction of a street giving access between the piers and the various business concerns adjacent to the made-ground.

"An unstable clay foundation, which has not yet dried out, afforded but little more than a spongy mass as a road basis. When it is considered that these streets must be suitable for hauling heavy machinery, possibly ten tons to the load, the character of the problem is evident.

"The necessity for permanent construction rejected the idea of a corduroy road of wood and the soft character of the foundation made macadam totally unsuitable for the heavy traffic.

"It was finally decided to lay a six-inch concrete slab reinforced near the bottom with a steel wire mesh. Upon especially soft spots a second thickness of the wire fabric was laid at right angles to the other.

"This Triangle Mesh reinforced roadway is giving good service and bids fair to solve one of the greatest problems of road building."

The design, supervision and construction were taken care of by Perry F. Brown, City Engineer; Harry Anderson, Commissioner of Public Works; T. E. Risley, Assistant City Engineer in charge of harbor improvements; Ransome-Crummey Company, contractors.

The Long Island motor parkway, constructed during the year 1908, is another type of a reinforced pavement. The work was done by the Hassam Paving Company, and constructed in accordance with their patents. After preparing the roadbed, about 2 inches of crushed stone was laid and on top of this was placed Triangle Mesh reinforced style No. 8, the longitudinal wires being placed parallel with the direction of the pavement. Then

REINFORCED CONCRETE PAVEMENT *on filled ground parallel to U. S. bulkhead and estuary, Oakland, California. Triangle mesh wire fabric used as reinforcing.*

additional crushed stone was placed of a sufficient depth to make the total finished slabe 4 inches thick after rolling with a 10-ton roller. A sand and gravel grout was then poured over the entire area until all the voids of the stone were filled and a sufficient amount remained on the surface to produce a smooth finish. Ten miles of this roadway 28 feet wide were laid without any expansion joints. The reinforcement was used to give added strength to the pavement and prevent depressions forming due to settlement of the foundation under the heavy automobile loads. Although the road has given very good satisfaction, the amount of reinforcement used was insufficient to prevent cracks forming across the pavement at regular intervals. The reinforcement used consisted of No. 12½ gage wires spaced 4 inches apart longitudinally and No. 14 gage diagonal cross wires spaced to form a 4-inch mesh. This is an exceptionally light material and should not be expected to prevent temperature cracks in pavements having no expansion joints.

## A Reinforced Concrete Chimney for the Municipal Water Plant, Clarksville, Tenn.

For chimney construction, reinforced concrete has come into very general use and occupies an undisputed position in this interesting field. It combines in a single structure all the elements of stability, strength and durability, and possesses all the requisites of a structure built with a view of permanence and beauty.

The reinforced concrete chimney has particularly found favor in municipal work, and has been adopted extensively for municipal electric light, gas and water plants, and the chimney described below, which was designed and built by The Weber Chimney Company, Chicago, gives an illustration of the successful use of this type of chimney at the water works plant of the city of Clarksville, Tenn.

The reinforced concrete chimney in question is of the type known as the Weber coniform chimney, so called by reason of its shape, the shaft being built as a true frustum of a cone. The chimney at all sections of its height is a true circle and the sides of the shaft are tapered at a uniform rate from top of chimney to top of foundation. The component parts are designed in accordance with the best engineering practice and the recognized and generally accepted formulas of professors Turneaure and Maurer are used as a basis for design.

The Clarksville chimney is 155 feet 6 inches above grade by 4 feet 6 inches internal diameter at the top, and was designed to withstand a wind pressure of 25 pounds per square foot of projected chimney diameter, which is equivalent to the pressure caused by wind with a velocity of 100 miles per hour. All tensile stress caused by the wind is taken up by vertical bars spaced uniformly around the shaft wall, ample vertical steel being provided so that the resultant unit stress in the steel will never exceed 14,000 pounds per square inch. The bars were placed about 2 inches from the outer face of the concrete. The horizontal reinforcement consists of ½-inch rings, the spacing of which was made dependent upon their lo-

cation. At all points where the chimney shaft is subject to heavy wind or temperature stresses these rings were very closely spaced to take up and distribute these stresses without the least injury to the walls of the shaft.

All compressive stresses produced by wind or temperatures are taken up by the concrete, the wall at all sections being made of sufficient thickness to keep down the compression to a very low and conservative figure.

As a protection against the hot smoke gases which would otherwise directly impringe upon the reinforced wall of the shaft, the chimney was lined with a reinforced concrete lining 54 feet high, the same built entirely independent of the shaft. A 4-inch air space was provided between the lining and shaft as a further protection. This type of lining has proven very successful in this as well as in several hundred other chimneys and is being built exclusively by the Weber Chimney Company who guarantee the same to successfully withstand all temperatures ordinarily met with in boiler practice.

The foundation is 18 feet square in plan and provides sufficient area to limit the maximum bearing on soil due to dead load and the wind load noted above to 2¼ tons per square foot. All bending stresses in the foundation are taken up by a system of horizontal reinforcement consisting of two rectangular nets and two diagonal nets of steel bars.

The shaft of the chimney was built with Weber patented unit wood forms, two sets of forms being used simultaneously, one on top of the other. These forms are made up in units which permit adjustment to a true circle of any diameter. The use of two sets of forms allows ample time for the concrete to set and avoids any possibility of the freshly poured concrete being distributed or broken up while raising forms, since the forms used are not raised as a whole but are divided into sections and each section is raised independently and again assembled.

WEBER CONIFORM CHIMNEY, *Clarksville, Tenn., water works. Lehigh cement used.*

All materials entering into the construction of the chimney were carefully tested in accordance with the requirements of the American Society for Testing Materials, which is the usual practice of the designers and builders of this chimney. The work was carried on under the direction of an experienced superintendent and was completed in May, 1912.

The strength of the construction is shown by the fact that a similar chimney at the water works plant of Council Bluffs, Iowa, went thru the recent cyclone which swept over Omaha, Neb., and Council Bluffs without the slightest injurious effect, altho the wind velocities were estimated to reach one hundred and twenty-five miles an hour. S. L. Etnyre is the superintendent of the Council Bluffs water works and selected this type of chimney after most careful consideration and bids upon all different types. This chimney is 138 feet 6 inches high and 5 feet 6 inches inside diameter at the top. An inner wall, which acts as a lining and is built of reinforced concrete, extends to a height of forty feet six inches. Both inside and outside diameters of the chimney decrease uniformly from the base to the top, the two cones, having the same vertical axis but slightly differing slopes.

## Settling Basin, Erie, Pa.

*By Frank Wilcox, Engineer and Superintendent T. A. Gillespie Co., Contractors, Pittsburgh, Pa.*

The settling basins at Erie, Pa., have proven to be very successful and are removing about 80 per cent. of the solid matter from the lake water. We excavated for these two settling basins on Presque Isle in 1909 and they were used

without lining until 1911. We then cleaned out the eastern basin and placed a 12-inch concrete lining all over the bottom and slopes.

The principal dimensions of Basin No. 1 (eastern basin) are as follows: Floor 500 by 320 feet; top of slopes 652 by 462 feet; depth from top of coping to top of floor 17 feet; bottom lining 12 inches thick; total area of basin, 6.9 acres; amount of concrete in lining 8,543 cubic yards.

The work was started in the spring of 1911 and finished about October 1, 1911. The concrete was mixed by a Haines mixer, carried by buckets on trains to the cableway and placed by the cableway.

Engineers were very particular in the selection of cement used in this work. Very thorough tests were made in accordance with the methods recommended by the committee of the American Society of Civil Engineers on uniform tests of cement. Briquettes made for testing tensile strength were broken with the Fairbanks testing machines. In every case where it was indicated that the cement was of inferior quality, duplicate tests were immediately made to make sure that no errors could creep into the laboratory work. Re-tests were made whenever the results of tests appeared questionable, even though they might have warranted the passing of the cement.

This basin covers five acres of ground and has a holding capacity of 24,000,000 gallons of water. Between 10,000 and 12,000 barrels of Lehigh Portland cement were used.

PLACING CONCRETE LINING *in settling basin No. 1, Erie, Pa.*

## Mechanical Trench Tamping

Several prominent western municipalities are considering the advisability of specifying that the back-fill on their trenches be mechanically tamped.

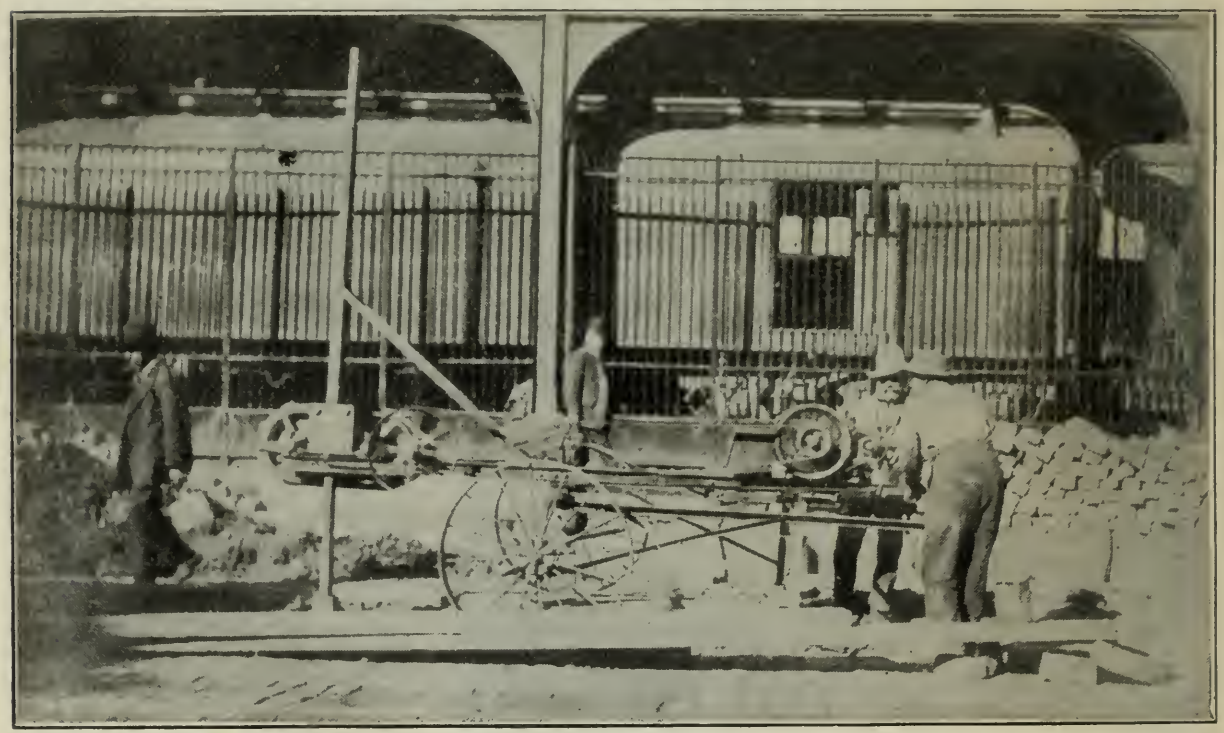
The Staley Tamping Machine, as made by the Lourie Mfg. Co., Springfield, Ill., which was among the pioneers in the field, has been considerably improved and fully one hundred of these machines are now in operation.

This machine consists of two principal parts: the sweep on which are mounted the lifting mechanism, the engine, etc., and the two-wheeled truck on which is mounted the sweep. The sweep of the standard machine is built of two 3-inch steel channels with the necessary spacers, bracing and truss rod. The sweep is mounted near its center of gravity, on a saddle casting which has a bearing on a pivot on the truck axle. The sweep swings in a horizontal direction on this pivot, thus moving the tamper across the work, while the movement along the work is had by moving the truck forward or backward about 8 inches for each complete swing of the sweep. The truck of the standard machine has 4 by 36-inch steel wheels; 1½-inch steel axle, arched; the truck-frame is formed of one piece of 2 by 2¼-inch angle, and a 2 by ⅜-inch angle crossbar riveted to the frame and legs; the legs are 2 by 2¼-inch angle; the bracing 1¼ by 1¼-inch angle. The steel axle spindle is cast into a square socket, thru which passes the vertical leg of the axle; the axle at this point is pivoted with about 8 inches of vertical adjustment, and a like amount of adjustment is provided in the cast iron shoe on the bottom of the truck legs. This adjustment will allow the machine to be operated with one wheel on the curb or other unlevel surface, and is a valuable feature when the machine is required to work close up to the curb.

The lifting mechanism is very similar to the well known board drop-hammer used for years in drop-forge shops. The mechanism as applied to the power tamp-

ing machine is even more simple than the drop-hammer. This lifting mechanism consists of two parallel rolls mounted on shafts running in bearings bolted to the sweep: the rolls are geared together by spur gears, and are driven by a pinion gearing into the gear on the rear roll; the driving shaft runs in bearings bolted to the sweep. The rolls and shaft are kept in line and adjustment by steel tie-rods which pass thru all the bearings and have nuts and lock nuts on each side of each bearing. The front lifting roll is pressed against the lifting board by coiled springs on the tie-rods passing thru the bearings and adjustable by nuts and washers. The length of stroke and gripping and releasing of the lifting board are automatically regulated by cutting away a part of the circumference of the lifting rolls. Thus the board is automatically gripped, raised and released, once for each revolution of the lifting rolls. The lifting board is of hardwood reinforced with a small steel channel on the edges and slides in long steel channel guides riveted to the sweep channels with a heavy gusset-plate, and braced from the top back to the sweep. Mounted in the gusset-plates just above the lifting rods, is a pair of grips or dogs which are connected by a short lever and bell crank; these grips are normally pressed against the lifting board by a coil spring acting on the bell crank, but when the lifting board is in motion the grips are held out of contact with it by a small rod and latch placed near the left hand of the operator. When it is desired to stop the motion of the tamper the latch is replaced and the grips prevent the board falling, but allow the lifting rolls to raise it the length of the stroke at each revolution, while the board is prevented from rising above a fixed point by reducing the thickness of the board near the lower end. When the reduced section rises to the center of the rolls, they do not grip the board and it thus remains in this position until it is released by the operator.

With the standard sized machine using a tamping head 8 by 9 inches in area, two laborers can tamp from 1,200 to 1,500 square feet of surface per hour, making one pass over the same. On trench work the machine will tamp ten layers in from 40 to 50 lineal feet of trench 30 inches wide per hour, making one pass over each layer. This machine will strike any square inch in a trench from 1 to 4 feet wide; it will strike any point at any level from 1 foot above the surface to 6 feet below. Number of blows per minute, 50 to 60. Length of stroke, 2 feet; weight of tamping head, 80 to 90 pounds; size of regular head 8 by 9 inches. Net weight about 950 pounds. Shipping weight about 1,250 pounds.



STALEY *Trench Tampin g Machine in operation.*

The machine is regularly equipped with a ten-foot lifting board, which will allow the tamper to reach a depth of 6 feet below the surface, which on account of the powerful blow struck by the machine will be found to answer for a depth of 8 to 9 feet. Where conditions require it, the

lifting board may be made in any length up to about 16 feet, which will allow the tamper to reach a depth of 12 feet below the surface. When the board is made longer, the weight of the tamping head is reduced to keep the total weight down to about 85 pounds, and the head is sometimes made of steel angles and plate. When the machine is to be used on surface work alone the sweep may be mounted on a narrow truck which will allow the tamper to cover an area wider than the over-all width of the truck, thus tamping a track for the wheels, and enabling the machine to clear fences, gates and posts, when used on sidewalk work. For extra wide trenches the truck may be built on a wider gage and of heavier material to meet the requirements. One sweep may be furnished with two trucks of different gage, and the sweep may be changed to either truck in a few minutes by removing four small bolts, and of course either truck may be used on any kind of work up to its capacity.

While one man can handle the machine on small trenches and surface work where the footing is good, on trenches that are wide or where the footing is soft, it will pay to have two laborers handle the machine, putting one man on each side of the machine, where they will be in the best position to keep the machine moving along the work and the sweep across. The power machine with two men to handle it should do as much work as from 8 to 10 men using the hand tampers, as the power machine will not shorten the stroke or reduce the number per minute, for this is automatically regulated, and the operator can give his whole attention to moving the machine over the work.

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## Concrete Sidewalk Construction

*By Spencer Bros., Kokomo, Ind.*

Proper mixing is frequently neglected in sidewalk work and it must be carefully watched. An excess of water must be avoided. It is not practicable to use as wet concrete in sidewalk construction as in some other classes of work. The top coating should have much more water than the lower layer and be of such a consistency as to work well under a trowel.

One of the common mistakes made by inexperienced workers is to mix too large a batch at one time; and then when the mortar has begun to set before it could be placed, to attempt to remix or retemper same. Under no circumstances should this be done, as once concrete or mortar has taken its initial set, or begun the hardening or drying out process, the addition of water or mixing will not delay this process. Any remixing of concrete after hardening has begun will generally weaken it to such an extent as to make it unsatisfactory. The saving which may result from the use of a portion of a batch of concrete which is retempered will not justify the introduction of uncertainties into the work. Retempered concrete should not be used. Any concrete left over at quitting time should be wasted.

In transporting concrete, care must be taken to prevent loss of material in any way. Wheelbarrows must not be overloaded. Loss of any surplus water in the mixture may rob it of a portion of the cement carried in suspension.

The concrete should be deposited within the forms on a subbase previously wet and tamped into final position as soon as possible. The surface of the concrete should be brought to a plane parallel to the proposed finished surface of the walk, and at a distance below it equal to the thickness of the wearing surface. To insure this the concrete should be struck with a straight edge long enough to span the walk, and notched out at the ends so that when placed on the side forms the straight edge will define the correct grade of the base.

The concrete should be dumped, not thrown or dropped from a height, as this tends to separate the stone from the mortar. No concrete should be placed upon a dry sub-grade. If this precaution is not taken it is certain that the porous material, absorbing a considerable quantity of water, will rob the concrete of much of the moisture it needs for proper crystallization and curing. The inspector should make certain that the specified proportions are accurately and uniformly adhered to. Mortar should be thoroly mixed and not allowed to look raw when deposited on the concrete base. If the mortar is not uniformly mixed, the surface will be irregularly colored and will contain pitted and honey-combed spots. Variable proportions of water should be avoided. A mortar mixed dry gives a darker finish than a wet one. The opposite sides of a stretch of walk will frequently appear to be of different shades, as the result of half of it being finished from one side, while the other half was finished from the opposite side.

The character of the finishing tool used in troweling the surface will affect the color or shade of the walk. A steel trowel gives a darker finish than a wooden trowel or float. If the top mortar is allowed to become too dry after being floated, and then finished with a steel trowel, it is apt to contain blotches which remain indefinitely.

In our sidewalk constructions we use the Standard low-charging mixers furnished us by the Standard Scale & Supply Co. These mixers on account of their having no charging device or special

mechanism other than the simple equipment and the mixing drum with low charging platform are simpler and more compact than most batch mixers. This enables the workman on the job to move the mixer in a small fraction of the time required to move large batch mixers and, in work requiring frequent moving, such as sidewalk construction, the mixer frequently pays for itself in a few months' time by the greater economy in moving alone.

We find it possible to conveniently keep these mixers in best position for rapid work. One of these mixers and a small gang of men will lay from two to three times as much sidewalk as the same number of men will accomplish mixing by hand, and the concrete is of far better quality. The machine will mix the top dressing as well as the base.

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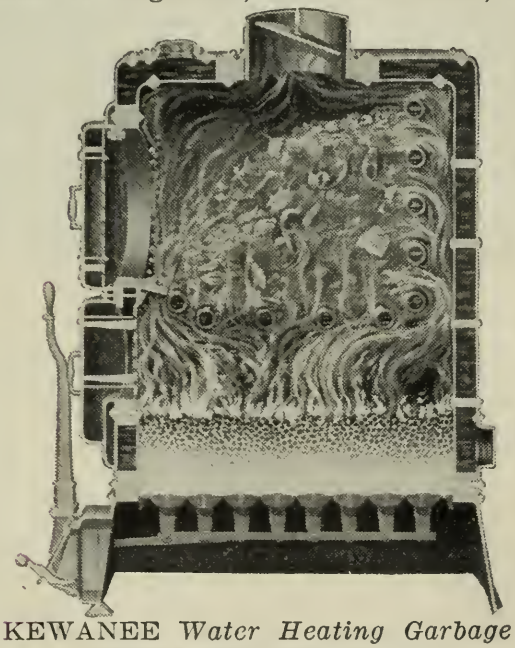
## The Question of Garbage Disposal

*By Elmer S. Leffel, Inspecting Engineer for Lehmann & Williams, Sanitary Engineers, Boston, Mass.*

The city councils of various municipalities, city and state boards of health, health officers generally and improvement societies, have been spending considerable time during the last few months agitating the question of garbage disposal. Much attention is given to considering the various methods of destroying garbage and refuse away from the place where it originates, while too little, or



KEWANEE *Water Heating Garbage Burner, sectional view.*

no attention at all, is given to the disposal of garbage at the place of its origin.

Manifestly, the cleanly way of disposing of garbage is by incineration. And if the garbage is destroyed thru burning while it is still fresh and untainted, it is a big advantage.

The garbage can is a birthplace of disease. On all sides we hear "Swat the fly," but the fly is a means of carrying disease rather than the source. The garbage can and the garbage wagon are both necessary to the breeding of flies. Eliminate the garbage can, the fly's dinner table, and you eliminate the fly. Furthermore, the destruction of garbage, by burning while it is still fresh, does away with the necessity of hauling it thru the city to the dump heap or to the isolated incinerator or reduction plant. Nothing is more disagreeable to the inhabitants of the city than the garbage wagon, in addition to the fact that it is a positive detriment to health.

There is another very important point in favor of the destruction of garbage at its place of origin. One ton of garbage contains, in heat value, the equivalent of 200 pounds of coal. Hence, garbage is worth as fuel, one-tenth of the price of coal. Therefore, the owner who has his garbage hauled away, is actually giving away good heat producing matter. In some cases he must pay to have it hauled away.

One big step forward toward the final solution of the garbage problem is undoubtedly the installation of garbage burners, in restaurants, hotels, hospitals, apartment buildings, and larger residences. Obviously the apartment building containing two, four, six or more families is a large producer of garbage. And figures have been compiled which prove beyond any doubt that a law compelling apartment owners to install garbage burners would be not an imposed hardship but an imposed economy upon the owner.

The problem of garbage disposal and the problem of hot water supply have become strangely related. There are today on the market several types of garbage burners which will satisfactorily burn garbage and refuse and at the same time use the garbage as fuel for heating water for domestic purposes. One type of the garbage burner mentioned is manufactured by the Kewanee Boiler Company, of Kewanee, Ill., and is known as the Kewanee water heating garbage burner. Figures which have been supplied to this concern, by owners of apartment buildings who have installed this garbage burner, show that the average cost of burning the garbage and of supplying hot water to the tenants of an apartment building is about 2 1/3 cents per day per apartment.

The Maryland Hotel, St. Louis, installed one of these garbage burners a year or more ago, and they report that

it is giving extreme satisfaction. This hotel has 125 baths, 255 washstands, and kitchen facilities large enough to take care of 1,000 people. Their statement is that this garbage burner not only supplies them all the hot water they use, but burns all the rubbish and trash, about twenty barrels per day, at a cost of 65 cents per day.

Further opportunity for the economical use of a garbage burner of this type is shown in the installation of a Kewanee water heating garbage burner in the ten-story and basement building, owned and occupied by Messrs. Lewis & Conger, New York City. The entire basement of this building is used as a shipping and receiving room, in the boiler room of which is placed a Kewanee garbage burner connected to a horizontal storage tank of 250 gallons capacity.

The burner is used to consume the waste material accumulating around the shipping, packing and receiving rooms, and this refuse, used as fuel, with the addition of 150 pounds of coal per day, furnishes sufficient heat to supply the entire building with hot water. This building requires about 2,500 gallons of hot water per day. The amount of heat required to raise the temperature of that amount of water 150 degrees, is approximately 3,200,000 heat units. In a pound of coal there are about 8,000 heat units, therefore, the 150 pounds of coal used supplies 1,200,000 of the 3,200,000 heat units wanted. Therefore the garbage, waste, straw, hay and paper used in the garbage burner provide two-thirds of the fuel necessary to heat all of the water used in this building. In other words, the waste material consumed is equivalent in value to from 250 to 300 pounds of coal. A fair average price of coal in New York City is $6.50 per ton, which makes it a fair figure to estimate the worth of this waste matter used, from a fuel standpoint, at from 82 to 90 cents per day. In this case the value is really three-fold. The rubbish, old papers, etc., are gotten out of the way, necessary hot water is heated and the fire risk is greatly reduced.

It would, of course, be folly to recommend the installation of a garbage burner in every establishment, but there is absolutely no doubt but what in a great many establishments, and this is possibly always true in the case of apartment buildings, a garbage burner would eliminote the garbage and would at the same time effect an economy for the owner in reducing the cost of the hot water which he must furnish his tenants.

## The Clark Meter Box

*By W. F. Anderson, Supt., Effingham Water Works, Effingham, Illinois.*

We have forty Clark meter boxes installed in sidewalks in this city, while but six are placed in pavements. We have 50 of these boxes in all, housing ⅝-inch and ¾-inch meters. These boxes, the average first cost of which is $3.50, can be installed anywhere and under all conditions.

The special combination type in use in this city has vitrified earth-box body 18 inches inside diameter.

We place the meters from 1 to 2 feet below the surface and 2 feet above the frost line as we believe that this location renders most convenient reading of meter. The bottom of the box itself extends 6 inches below the frost line. The partial burying of the cover with the sidewalk or other material, combined with the dead air space within the box and the radiating surface of the warm air at the bottom of the box insures absolute protection from frost. We have never experienced any freezing of our meters when housed as above described.

The following table giving degrees of temperatures inside and outside of box in extremely cold weather on the different dates mentioned, is indicative of the efficiency of these boxes:

| Date. | Temp. in box. | Temp. outside. | Ground frozen.. |
|---|---|---|---|
| Feb. 2, '12 | 48 | 10 below zero | 14 in. |
| Feb. 20, '13 | 52 | 20 below zero | 6 in. |
| Feb. 27, '13 | 46 | 10 below zero | 12 in. |

Many of our ordinary or basement installations of meters froze on above mentioned dates.

It may be interesting to know that snow or ice does not ordinarily collect on the covers of our meter boxes as the warmth of the air inside of box is sufficient to keep the cover at such a temperature that snow melts as fast as it falls on the cover. We have never experienced any trouble on account of breakage of lids or covers and we believe they are built heavy enough to withstand the most severe traffic conditions.

We have never experienced any trouble with the locking device, which we believe is exceedingly simple in operation as well as speedy, as it requires our inspectors an average of one minute to unlock, make the reading and again lock the box.

We have made it a practice of furnishing sidewalk contractors with temporary covers with ring forms for their use in the laying of sidewalks. These temporary covers and ring forms are exceedingly simple in operation and enable the contractor to proceed with his sidewalk con-

struction with hardly any loss of time. These castings are very carefully made and are of exactly true pattern.

Outside installations are accessible at all times and it is our belief that those municipalities having outside installations can cut down their cost of meter inspection fully 50 per cent. Fully 40 per cent. of our installations now have outside housings and we contemplate this systematic setting of our meters thruout our whole system. In other words all meters installed from this time on will have outside housings in accordance with above described method. These meter boxes are furnished us by the H. W. Clark Company, Mattoon, Illinois.

## Sheridan Boulevard Pavement Extension Successful

Numerous boulevard improvements and drive extensions are planned for the three park systems of Chicago. The experimental 40-foot drive which extended the Sheridan road pavement a distance of 4,631 feet in 1910 has been pronounced a success. The stretch was so built as to allow the water to run off the street onto the lawn at the side, which is graded so as to form a hollow along each side of the road. The road is 40 feet wide with a 7-inch crown, and has 2 inches of asphalt on an 8-inch base of crushed stone. At the sides of the drive are reinforced concrete curbs 5 inches thick, extending from the surface of the street 24 inches deep. The top ½ inch of the curb is surfaced with a grout containing ½ pound of lamp black per bag of cement, for the purpose of giving the top of the curb the same appearance as the asphalt street. Many similar extensions are contemplated.

The concrete curb was formed by 16-foot panel forms, of which there were about 500 lineal feet employed. The curb was reinforced with three ½-inch square bars. These were 20 feet long and lapped 6 inches at the ends. They were suspended in the forms in templets made of a ¼-inch piece of pine, which was left in place to form the expansion joint.

The total amount of asphalt upon the street amounted to 22,318 square yards, and was placed 2 inches thick. The material was mixed in a Twentieth Century portable asphalt paving plant as manufactured by the Link Belt Co., Chicago, in the following proportions:

| | Lbs. |
|---|---|
| 1 part torpedo sand | 168 |
| 1 part bank sand | 168 |
| 3 parts ½-inch stone | 504 |
| Asphalt | 81 |
| Total 7 cubic feet or 1 box | 921 |

The asphalt used was a fluxed Gilsonite. Part of the work was done with Sarco and part with Pioneer asphalt. Altho the work has been laid three years, it has nevertheless shown no signs of wear or deterioration under a heavy automobile traffic. The asphalt work was commenced April 29th, and was completed July 9, 1910. The costs follow:

| Labor. | Time, hrs. | Rate. | Total. |
|---|---|---|---|
| Engineering | | | $ 57.18 |
| Foreman | 566½ | $150.00 mo. | 362.01 |
| Sub-foreman | 2 | 125.00 mo. | 1.07 |
| Sub-foreman | 28 | 3.00 day. | 9.33 |
| Sub-foreman | 4 | 2.50 day. | 1.10 |
| Troy dump wagons | 439 | .66 2/3 hr. | 159.29 |
| Troy dump wagons | 421½ | .25 hr. | 105.38 |
| Two wheel carts | 469 | 12½ hr. | 57.63 |
| Common labor | 1,579 | .38 hr. | 608.10 |
| Common labor | 18 | .35 hr. | 5.30 |
| Common labor | 1,510 | .30 hr. | 453.00 |
| Common labor | 13 | 2.50 day. | 3.61 |
| Skilled labor | 16,122½ | .25 hr. | 4,030.63 |
| Timekeeper | 97 | 65.00 mo. | 25.25 |
| Steam roller engineer | 1,836½ | .50 hr. | 918.25 |
| Machine man | 438 | 3.15 day. | 153.12 |
| Machine man | 325 | 2.80 day. | 100.17 |
| Teamsters | 8 | 2.62 day. | 2.34 |
| Teamsters | 878 | 60.00 mo. | 224.70 |
| Tools | | | 479.88 |
| Derrick | | | 60.00 |
| Total cost | | | $7,817.34 |
| Labor cost per square yard | | | $0.352 |

## Reinforced Concrete Pavements in St. Johns, Hamtramck, Port Huron and Rockville

The city of St. Johns, Mich., laid during 1913 approximately 15,000 square yards of reinforced concrete pavement consisting of a base 5 inches thick mixed in the proportion of one part portland cement to seven parts of gravel including sand. The top or wearing course is 2 inches thick, mixed in the proportion of one part of portland cement to three parts of clean sharp sand. Triangle Mesh reinforcement, style 29, was used as a reinforcement, the same being placed be-

tween the base and wearing course. Expansion joints were constructed along the curbs and across the street every 30 feet, all joints being protected with the Baker armor plate, which consists of a flat piece of steel about 3/16 of an inch thick and 2½ inches wide, bent to conform to the shape of the finished pavement. Two plates are used in each joint and are separated from ¼ to ⅜ of an inch. They are held in place by means of shear members which occur about 12 inches apart and are bent back at right angles to the plate and extend into the concrete. This pavement was designed and supervised by E. G. Hulse, city engineer, the contractor being James A. McKay, of Clare, Mich.

A very successful reinforced concrete pavement has been laid in Hamtramck, Mich., a suburb of Detroit, the same having been designed and constructed by the R. D. Baker Company, Detroit, Mich. During the year 1913, 15,000 square yards were laid, having a base 5 inches thick, consisting of a concrete mixture of one part portland cement, three parts of sand and six parts of crushed stone. The wearing course is 2 inches thick, mixed in a proportion of one part portland cement, one part of sand and two parts of crushed granite having a size not to exceed ½-inch. The reinforcement used was Triangle Mesh, style 28, placed between the base and top course, and was laid with the longitudinal wires at right angles to the center line of the street. Expansion joints were placed along the curbs and every 30 feet across the street, and were protected by means of the Baker armor plates. The cost of the finished pavement was $1.35 per square yard exclusive of excavation, the material and labor costs being as follows:

Cement, $1.02 per barrel.
Sand, 75 cents per cubic yard.
Crushed stone, $1.15 per cubic yard.
Crushed granite, $3.15 per cubic yard.

All above being f. o. b. cars, Hamtramck,.

Common labor cost $2.60 per day.

The city of Port Huron, Mich., laid about 9,000 square yards of reinforced concrete pavement in the year 1912. This pavement had a total thickness of 7 inches, consisting of a 5½-inch base and a 1½-inch wearing course. The concrete for the base was mixed one part portland cement to five parts of river-run gravel. The wearing course consisted of one part cement, one and one-half parts sand, and one and one-half parts of ¾-inch crushed field stone. Triangle Mesh reinforcement, style 4, was placed between the top and bottom courses. Expansion joints were placed every 16 feet across the street, and, where car tracks occurred, joints were placed one foot from the track on each side for the full length of the street. All joints were protected by the Baker armor plate. The price of the finished pavement was $1.22 per square yard exclusive of excavation. The material and labor costs were as follows:

| | |
|---|---|
| Cement, per barrel | $1.02 |
| Sand, per cu. yd., f. o. b. the work | 1.15 |
| Gravel, per cu. yd., f. o. b. the work | 1.15 |

Common labor was $2.25 to $3.00 per day.

The designing engineer was E. R. Whitmore, Port Huron, Mich., the contractors being J. H. Baker & Son, Port Huron, Mich.

The city of Rockville, Ind., constructed during 1912, 4,400 square yards of reinforced concrete pavement. This pavement was of a different type than the ones listed above, it being a one-course instead of a two-course type. Altho the use of a reinforcement necessitated placing the pavement in two layers, both layers consisted of the same concrete mixture, this being one part of portland cement, two parts of sand and two and one-half parts of gravel. The total thickness of the pavement was 5 inches and the reinforcement was Triangle Mesh reinforcement, style 7, placed approximately in the center of the slab. The curb is 6 inches high and 5 inches thick, built directly upon the pavement and anchored to the same by means of steel loops placed every 5 feet. Expansion joints occur every 33 feet across the pavement and are protected by means of the Baker armor plate, the joints being filled with tar. The finished pavement cost $1.10 per square yard including excavation and the material and labor costs were as follows:

| | |
|---|---|
| Cement, per barrel | $1.25 |
| Sand, per cu. yd | 1.25 |
| Gravel, per cu. yd | 1.25 |
| Common labor, per hour | .20 |

Very little excavation was required beyond surfacing to grade. The foundation consisted of a yellow clay which required the depositing of a small amount of gravel in some plaecs. The crown of the street was 4 inches for a width of pavement of 26 feet. The designing engineer was H. L. Davies, of Judson, Ind., and the contractors were Ireland Brothers, Bloomingdale, Ind.

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## Efficiency in Unloading Road Oils

In pace with all of the many labor, cost and time saving methods and machines in other walks of life, there has been perfected and patented an oil heater and forcer which is a necessity to anyone having road oils and tar to unload from cars or storage tanks. It will drain a car completely without a drop of waste at the rate of 100 gallons a minute, delivering the oil to sprinkler wagons at a high

temperature and requiring but one man to operate.

It spells efficiency in a score of different ways. It will pay for itself in less than one season. A sectional view illustration and circular fully describing this attachment should be in the hands of every contractor and street building official, and may be obtained by addressing the Eastern Office of MUNICIPAL ENGINEERING, 1125 World Building, New York City.

## Warrenite Pavement Withstands Flood

New Haven motorists are rejoiced to find a warrenite pavement on the old macadam crossing the meadows between Middletown and Cromwell. The roadway at the point stated, has become well nigh unendurable. The new pavement has been laid upon the old macadam and the improvement is a notable one. A portion of this road was flooded at the time of the recent rise in the Connecticut river but no material damage was done to the highway by the receding waters.

## Automatic Blue Printing Machinery

*By Geo. J. Kirchgasser, The Cutter-Hammer Manufacturing Co., Milwaukee, Wis.*

In the manufacture of motor controllers, which comprise thousands of devices from the small rheostat for simply starting an electric motor to the large automatic control panels which are used to start, accelerate, slow down and stop motors driving high speed elevators, industrial cranes and hoists, huge steel mill machinery, water works pumps, printing presses, etc., many blue prints are required. Practically all but the simplest types of these controllers must meet special requirements. The design, wiring connections, assembly or construction differ in most cases. Many drawings and blue prints are required, both for the shop in building, and for the erection men, when installing. With such a vast number of blue prints to be made, stationary sun-printing frames are out of the question and rapid machine printing, which eliminates the uncertainty of "Old Sol" is necessary.

The location of the blue print room of The Cutler-Hammer Mfg. Co. is on the same floor as the drafting room, being really a part of the latter. The clerk in charge of the tracings supervises the blue print work, which is done by one young man usually. In times of rush work one of the drafting room apprentices helps out. The windows and door of the blue print room are of colored glass.

It is a distinct advantage to have the blue print room located as it is. No time is wasted in sending tracings, a general supervision of the work can be easily exercised, and confusion and mistakes are avoided.

The machine used is known as the Pease peerless printer and during the year and one-half of use it has been very satisfactory. The accompanying illustration shows the only installation view possible as the room is not much wider than the machine and a front view only could be photographed.

The blue print paper, a yard wide and coming in rolls of 50 yards is put on a roller and passed into the machine. The tracings are fed in at the front and are carried around a glass cylinder in which five arc lamps are installed in a row. After being used for printing in this manner the tracings are returned to the tracing catcher, which is just above the feeding-in shelf. Having the tracings returned in this way instead of having them carried thru the machine, makes it possible to make many prints from the same tracings quickly, as they can be fed in as soon as they reach the tracing catcher.

The paper is passed thru a weak acid bath at the rear, from which it is run over a roller at the top. But, as it passes up, water from a perforated pipe is sprayed on it, above which is a gas heater. During the time that the paper goes up one side over the roller and down the other it is dried by the heater, after which it is passed thru a number of rolls and finally rolled up on a roller. By this time the paper is smoothed out and can be cut as desired.

The feeding mechanism is driven by a ⅛-h.p. 110-volt direct-current shunt motor located below the feed shelf. This is geared for two speeds and is also provided with a Cutler-Hammer regulator for further variation of the motor's speed. Good new tracings are fed faster than old ones as also are penciled tracings. Pencil tracings heat up quicker. Photographic negatives from which many blue prints are made are run thru at a slower rate, the ratio being about as 4½ is to 6. For removing the heat developed by the arc lamps in the glass cylinder a 12-inch fan is used, located at one end. A small 1/12-h.p. vertical motor of the same type as the other is used to drive the drying rolls.

No record has been kept of the largest output for a single day, but very frequently a great rush of work is put out in a day. The average quantity of blue print paper used per day is between three and four rolls of paper, 50 yards

per roll. This is equivalent to about 150,000 feet or about a half million tracings 9 by 12 inches. Some days the machine is in operation eight hours, while it may on other days be used only four or five hours.

Much of the work consists in making wiring diagrams and data sheets, 9 by 12 inches, small data sheets of type written copy for engineer's notebooks, 4½x 7½ inches, construction and detail diagrams, 12 by 18 inches and larger, and blue prints of photographs.

The cost of maintenance during the year and a half of installation, has been almost nothing. Of course, the carbons for the lamps are renewed and one of the snap switches has had to be repaired. The cost of operating the two small motors per month at 4 cents a kw. hr. is $1.25 and of the lamps about $16. There is no way of computing the cost of the gas used for the dryer as it is not metered separately. Machine blue-printing is the only way that the amount of blue print work turned out could be done. Little space is required, speed and reliability are attained and the cost is low.

## The Johnston Sprayer

The Massachusetts State Highway Commission has been one of the foremost advocates of the surface treatment method of road construction and maintenance, and the great number of excellent roads within the state and the prominence given to Massachusetts among the states foremost in the good roads movement testifies to the soundness of its judgment in this particular line. J. A. Johnston, one of the division engineers of the Massachusetts highway commission, under whose direction a good deal of the work of saving the famous state roads of that state has been done, has produced a machine from his experience of the needs which will apply any bituminous material so as to preserve the surface of a macadam road or to build up a gravel one.

The Johnston sprayer is constructed as a separate unit mounted on two wheels, to be attached behind a tank wagon, and the whole to be drawn by a steam roller or tractor, from which steam is supplied for heating the oil or tar, and operating the sprayer. The spraying machine consists of a duplex steam pump with fittings so arranged as to give the best results with the least trouble. All parts are readily accessible and easily cleaned.

While the Johnston sprayer can be set to give any pressure desired from gravity up to 200 pounds per square inch, not less than 70 pounds is advocated, because this has been found to give excellent results after three years' trial on roads in Massachusetts, and for a longer time in Europe. The heavy pressure forces the bitumen into every crack and cranny of the road surface and by dislodging any light film of dust results in the thoro adhesion of the bitumen to the particles composing the road. The nozzles of the Johnston sprayer are so set as to drive the bitumen in a direct line to the surface, giving the greatest possible penetration.

With a Johnston sprayer the contents of a 700-gallon tank wagon can be distributed on the road in 25 minutes, and the resultant coating will be absolutely uniform if ordinary care is used. The suction connections with the tank wagon are all metal, there is no rubber hose or gasket to rot out under the action of hot bitumen.

There is a seat for the operator on the rear of the machine, with controlling valves and levers for steam and bitumen which are within easy reach of his hand. It is perfectly feasible, with the steering feature on the Johnston sprayer, to run the machine exactly on a given line. The spray nozzles on the Johnston machine are set 9 inches on centers, and the spray pipe can be extended to any length that is a multiple of 9 inches. The importance of this feature has been found to be very great, for experience shows that without this, it is difficult to so guide the tractor that the desired area is properly covered by the distributer. The control of the quantity and the place of application of any material used is at will of the operator.

The greatest economy is obtained from the machine by using the lightest form of wagon possible. Any grade of oils or tar from the lighter to the very heavy bitumens may be applied with this machine.

The sales agents for the Johnston sprayer are Wm. F. Irish (engineers), Room 42 Whitehall Building, New York City.

## Chain Belt Paving Mixer

After three years of constant study and application to the street paving problem, the Chain Belt Company, of Milwaukee, Wis., have ready for distribution the Chain-Belt street paver.

This mixer is the same general design as the standard side-discharge Chain-Belt mixer.

The street paver has a chain-belt drive, cast semi-steel bulge drum, chilled rollers with bronze bushings, all steel frame, etc.

This machine is especially designed for laying concrete pavements but it can be used for any class of work, and is well adapted for mixing concrete for bridge abutments, etc. It is provided with a re-

versible traction drive so that the mixer can be moved forward or backward by its own power. The traction drive is fitted with a friction clutch, and to move the machine ahead it is only necessary to throw in the clutch, and to stop the machine, throw out the clutch. The traction drive is connected to both rear wheels and is sufficiently powerful to propel the machine up an incline of 15 degrees.

The front axle is of the automobile steering knuckle-joint type, and the rear axle is a compensating differential. The latter is advantageous in that it will equalize the speed of the rear wheels in turning corners. Wheels are heavy crucible steel castings 9 inches wide.

No platforms or runways are required, and if the material is placed sufficiently close to the machine, it can be shoveled directly from the supply pile to the open end power loader bucket. All levers are so arranged that one man can operate the entire machine if necessary. The operator stands on a platform on one side of the machine, about 30 inches above the ground, and can operate the power loader, water tank, discharge and boom. The Chain-Belt paver is capable of turning out a batch of concrete in 45 seconds.

### Concrete Distributing Boom

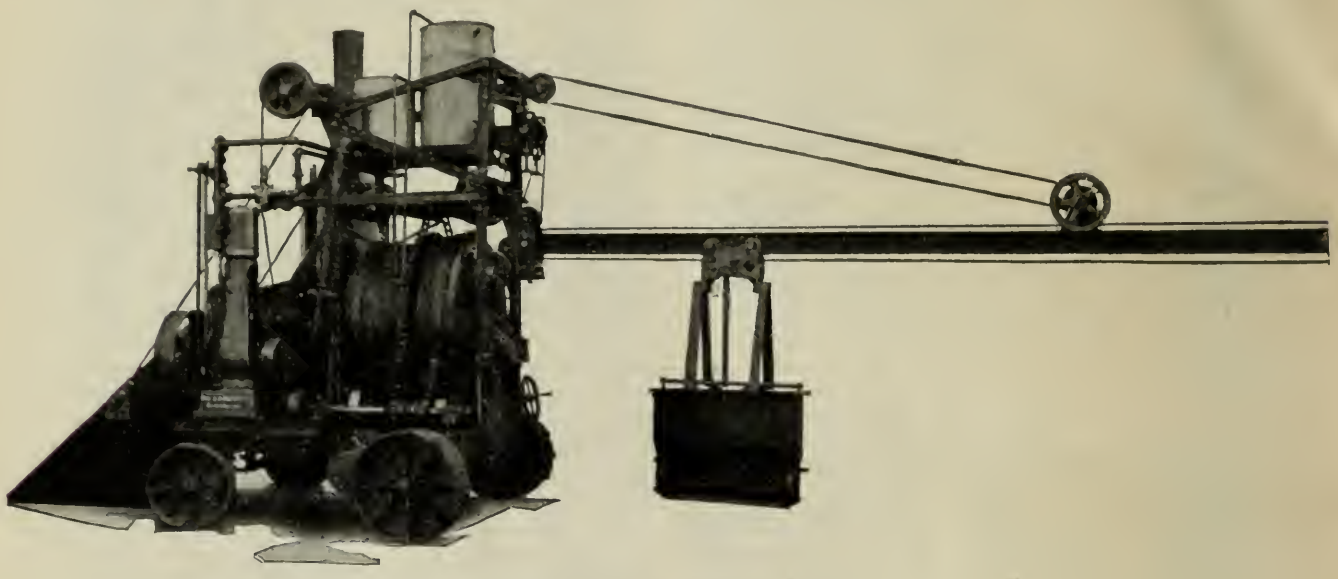
The Chain-Belt street paver is equipped with a boom 20 feet long and a delivery bucket. Paving contractors have found this the most economical method of spreading concrete on the streets as it eliminates the use of wheelbarrows and carts.

The concrete is discharged from the mixer into the delivery bucket, which travels on a single boom. The boom can be swung thru an angle of 180 degrees, and a street 50 feet wide can be easily taken care of. The boom bucket will hold a full batch of mixed concrete and is provided with an automatic tripper, and the gate opens up automatically at any place where it is desired to deposit the concrete. When bucket returns to the mixer, the gate closes automatically. The same man who operates mixer levers also controls the movements of the boom and bucket.

In work where the road is less than 18 feet in width a gravity swivel chute may be substituted for the distributing boom.

The Chain-Belt street paver is made in three sizes: 10, 15, and 25 feet respectively.

The No. 12 weighs 11,000 pounds, the No. 15 weighs 14,000 pounds, and the No. 23 weighs 17,000 pounds.



CHAIN BELT *Paving Mixer.*

## Hand-Power Bar Bender

The illustration herewith shows a hand power bar bender machine for concrete reinforcement or other heavy bending. This machine is made by the Wallace Supply Company, Chicago, and can be operated by one man and will bend 1¼-inch high carbon bars, or under, cold. The ratchet lever operates the pinion against a series of teeth in the frame, at a ratio of 12 to 1. The dies are adjustable by means of set screws to suit thickness of stock to be bent.

Economical methods in construction work depend to an extensive degree upon the working devices and equipment provided engineers and contractors in the various departments of work. For example, the problem of bending cold materials readily and adaptively into every conceivable form and shape was for many

years of deep concern to building interests. Particularly has this been true since concrete construction has become one of the world's largest and most necessary industries. In the various forms and possibilities of concrete construction there exists an almost endless variety of uses to which steel bars, pipings, etc., are put and the possibility of extensive and adaptable use of these materials depends solely upon the apparatus or equipment provided for bending these materials into usable form.

During the last few years great progress has been made providing bending tools for all varieties of work, and while many of the devices were planned along intelligently considered lines, it is nevertheless true that a large number of these

BAR BENDER *made by Wallace Supply Company.*

devices were either ineffective in actual use or on the other hand were not dependable in application.

Among Wallace hand power bending tools can be found angle benders, ring benders, I benders, bar benders, pipe benders, conduit elbow former and combined iron forming, fluting and bending machine.

## Value and Cost of Operating Gasoline Diaphragm Pumping Outfits

In response to inquiries from MUNICIPAL ENGINEERING several contractors and engineers have given definite information regarding the use of diaphragm pumps operated by gasoline engines for removing water from trenches and other excavations, which will be of value to others. Some of this information is given herewith.

The Phoenix Construction Co., contracting engineers, 4 Park Place, New York, write as follows:

"We have used but one type of diaphragm pumping engine. This was the Atlantic diaphragm pumping outfit, which consisted of a small gasoline engine and 3-inch diaphragm pump. The cost of operating, for gasoline and oil, was about 3 cents per hour, and required very little attention, taking altogether about two hours of a man's time during an eight-hour day. This outfit replaced two hand pumps of the same size each of which was operated by two men."

Ambursen Hydraulic Construction Company, 88 Pearl street, Boston, Mass., say:

"We use on all of our works a diaphragm pumping engine, operated by a gasoline motor. It is manufactured by Harold L. Bond Company, 391 Atlantic avenue, of this city, and is called the "Atlantic pumping engine." We have never used any other make or design and have never compared the cost of operation of these pumps with the cost of operation of any other sort of pump. For years the writer has used the Edson diaphragm pump, operated by hand on account of its convenience for small pumping operations and its convenience in transportation from place to place. These pumps will discharge quite a considerable amount of water and at times of necessity, four men have been employed on one pump. Recently the Bond Company have attached a gasoline motor to this type of pump, and have enlarged the capacity of the pump; the whole thing being light and portable. This pump, with the expenditure of a moderate amount of gasoline, will do the work of ten men. There is therefore no question of the value of such a pump as compared with a hand pump. We find it good practice, however, when larger pumping capacity is required, to install centrifugal or some other type of pump operated by steam."

Byron E. White, engineer of the Utica Gas and Electric Co., writes:

"We have had a diaphragm pumping engine, made by the Harold L. Bond Co., for about a year and a half. We have not used it very extensively, but on two short jobs that I am particularly familiar with we have found it most satisfactory. In the fall of 1911 I was engaged in digging some test pits in a gravelly formation in the bed of West Canada creek and had at times four and six men working ordinary bilge pumps and they were unable to keep the water out of the put. The pumping engine, however, was able to keep the pit drained with ease and could have handled considerable

more water, if necessary. Within the past few days we have been using it to drain a trench for a gas main under the Erie canal here in Utica, where it replaced four men using hand diaphragm pumps."

## Cement Culvert Mold

The Francis Machinery Co., 5 Market street, St. Louis, Mo., makes a galvanized steel adjustable mold for making cement culverts which has some excellent features. There are several holes punched in each end of each section into which bolts can be inserted. The maximum size culvert for the sheet used is built by putting these bolts thru the outer holes, thus making the largest circle possible and lapping the sheet only a few inches. The diameter of the form can be reduced to suit the smaller diameters of culvert by drawing the sheet in and making the necessary overlap and then inserting the bolts to hold it in shape. The bolts are made easy to change by the use of thumbscrews on the inner ends. The form can be collapsed by similar movement after the concrete has set. A small block and tackle is supplied with each set of molds to aid in making the adjustments.

The 3-foot sections can be fastened together, an end of one slipping over the end of the next and the two being fastened by the same bolts, thus making the form of any desired length.

The sections are light and easily handled and transportation cost is low.

## Aztec Asphalt

Aztec asphalt is distinguished as a bitumen 99.5 per cent. pure, made from Mexican asphaltic oil from the State of Vera Cruz, which is prepared for the market as a refined asphalt for paving and other purposes, an asphaltic cement with the flux added, an asphaltic road oil for use cold and also for use hot in treating road surfaces.

The analyses and tests made by the experts in bituminous paving materials show it to be practically pure bitumen and to have at the same time very high cementing value and durability and much less susceptibility to changes in temperature than the standard foreign and American asphalts.

Streets laid with the asphalt and roads treated with the road oils in several states and large cities are showing that the practical results will bear out the opinions expressed. The U. S. Asphalt Refining Co., 90 West Street, New York, has a large refinery at East Brooklyn, Baltimore, Md., to supply the market.

## A New Calculating Machine

Mr. F. A. Belt, of Mt. Washington, Ohio, a district inspector under Chief Engineer Waite, of Cincinnati, has invented a new, easy and rapid method of getting cubical contents for structural concrete work, board measure for form work, circumference, areas, square root, decimal equivalents, etc; also, conversion of metric-English and English-metric. These results are accomplished by four charts wound separately on double rollers geared and operated by separate handles. By the rapid mechanism any desired column on the charts is brought to view thru the longitudinal openings on face of calculator, and the result of any multiple thereof is instantaneously shown. One chart is a multiple of whole numbers, another of fractions down to 32nds, enabling one to multiply and divide mixed numbers very rapidly. The other two charts represent cubical contents in linear feet and inches. By adjusting these charts to the required length a reading in cubical feet is had instantaneously, and correct to the thousandth part of a cubical foot. There are several ingenious combinations which greatly extend the value and convenience of the machine. Full information can be had by addressing Mr. Belt.

## Selling Water at a Profit

*By A. W. Seng, Supt., Municipal Water and Light Plant, Sylvan Grove, Kan.*

While it has been frequently proven that many water plants show big losses thru water leakage, it is my earnest belief that the great majority of those plants in the loss column are so placed on account of excessive operating costs. The cost of delivering one million gallons into the mains includes such items as fuel, handling it, salaries, oil and waste, wear and tear, labor, interest on the capital invested and other fixed charges. All this added together may total something like $40 per million gallons. But the saving of this same million gallons does not put anything like $40 into the city's pocket, since the fixed charges, etc., remain unaltered, and the labor, supervision, repairs and salaries, etc., do not come down, even if a saving of 40 or 50 per cent. is accomplished.

The oil and waste may be taken as proportional to the number of revolutions of the pumping engine, i. e., to the amount pumped. It is likewise reasonable to assume that the consumption of fuel decreases in proportion to the reduction of horse power required. This latter assumption, however, takes it for granted that the combined efficiency curve at the point corresponding to the existing con-

ditions is fairly flat, which will generally be the case.

Before installing our municipal water and light plant, we investigated very carefully operation and maintenance costs of different types of equipment, deciding in favor of that type requiring small amount of fuel as well as possessing fuel saving advantages when not in actual operation. Cost of attendance was also very carefully considered.

Our plant, which was installed during the months of November and December, 1911, at a cost of $22,699.00, by the Commercial Construction Co., Kansas City, Mo., and which has been in operation a little over sixteen months, has given very satisfactory service. This plant, which we believe has made an exceptional record from an efficiency standpoint, has the following equipment:

One 50-h.p., 2-cyl., Fairbanks-Morse, internal combustion oil engine.

One 32-h.p., 1-cyl., Fairbanks-Morse, internal combustion oil engine.

One 37.5-k.v.a., 3-phase, 2,300-volt, 60-cycle alternator.

One 1.5-k.w. exciter.

One 2-panel switch-board.

Transformers, 2,200-110.

One 35-lamp, constant-current, 3.5-amp., tungsten street-lighting circuit.

One 7 by 8, triplex power pump (Smith-Vaile).

One 50,000 gallon stand-pipe.

The city sells current to its patrons at 15c per kw. hr., $1.25 minimum. Water at 25c per 1,000 gallons, $1.00 minimum.

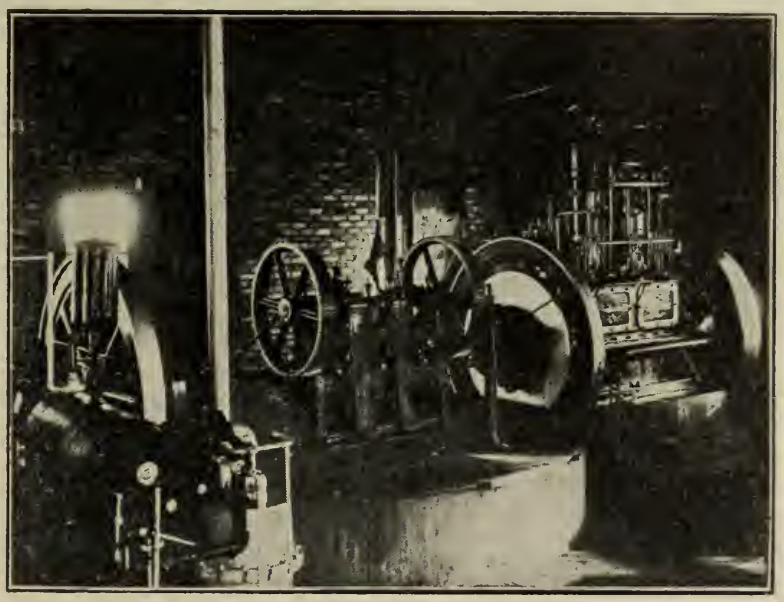
The schedule for current is one hour before sundown till 12 o'clock at night, and 5:00 a. m. till one hour after sun-up, and Wednesday afternoons for ironing, etc., or about 10 hours per day.

The population of this town is about 600.

The city made a profit of about $200.00 during the months of December, 1912, and January, 1913, or a profit of about 50 per cent., but the average profit for the last six months was 33 per cent. However, most of this is used to pay for new connections, extensions, meters, etc., and what is left goes into a sinking fund for upkeep of the plant.

The power oil used is a 40 gravity distillate which costs us five cents per gallon tank-car lots.

The 50-h.p. engine drives the alternator by belt and is direct connected to pump by clutch, which it runs when lighting load is light. These oil engines are giving excellent service and are efficient, economical and powerful. They give every bit as good regulation as steam and are no harder to keep up. They have electrical ignition and will run on gasoline, kerosene or solar oil but have much more power with kerosene or distillate than with gasoline.



OIL ENGINES AND PUMPS, *in the municipal water and light station at Sylvan Grove, Kan.*

The only objection to them is that they are a trifle more noisy than a steam engine. They do away with an expensive boiler plant and its attendant evils as well as saving the cost of hiring an extra man.

This plant has been in operation for sixteen months and has lost less than one hour's time due to shut down, and has run over four months at a time without a bit of trouble or stop.

One of the noteworthy features of our plant is the fact that the pump is directly

connected to either engine by clutch. Our engine will run pump and alternator at the same time and when the pump is on there is not the slightest fluctuation in voltage. The particular advantageous feature of this type of engine is that they are exceedingly economical in operation. They can be started in less than five minutes time and need scarcely any attention when running. They require very little attention and run with perfect regulation, having a gear-driven throttling governor, butterfly type, which regulates speed within 3 per cent. from no load to full load.

This type and size of engine is well adapted for our needs, as our city is not a large one and they can be operated more economically and readily than a steam engine, especially as it is operated only about ten hours per day. It may be started or stopped at any time upon a moment's notice. A steam engine installed in our plant would have cost considerably more and would have required an extra man to operate. Both of our Fairbanks-Morse combustion oil engines use gasoline, kerosene or distillate equally well. Both of the engines have their line shafts on same center with pump between them.

Our 50-h.p. engine is used for running generator and pump while we use our 32-h.p. for pump purposes only. The source of our water supply is two wells, 30 feet apart, four feet in diameter, 35 feet deep and curbed and lined with brick; balance 12-inch iron casing. Total depth of the well is 65 feet, depth of pit 35 feet and depth of water 20 feet. We have four miles of mains.

## Refuse Destructor at Halifax, N. S.

The new refuse destructor of Halifax, N. S., was tested on March 8 and accepted. The plant was constructed on specifications prepared by City Engineer F. W. W. Doane, on plans presented by the Griscom-Russell Co., of New York, the American representatives of the Hughes and Sterling Co., of London. The contract was awarded to them in competition with three companies in April, 1912.

The plant consists of one unit with three grates, top container fed type, with 200-h.p. water-tube boiler, the destructor having a capacity of 50 tons in 24 hours.

The concrete building and the run way for the collection carts to reach the storage hoppers and charging chutes and containers is shown in one of the accompanying photographs. The chimney of radial brick type is 115 feet high and 6 feet interior diameter. A rotary crusher, screen and elevator prepare the furnace clinker for city uses.

Following are official figures taken from the report of the test and show the completeness of the work done and the power obtained:

The combustion of refuse at the test was at the rate of 70 tons in 24 hours, exceeding the guaranteed capacity by 40 per cent. The calorific value of the refuse was very low, the analysis of the residues

FRONT OF GRATES *of Sterling destructor at Halifax, N. S.*

on one test showing 40 per cent. of fine dust, 37 per cent. of ash, and 23 per cent. of clinker.

Duration of test, 4 hours 8 minutes.
Number of grates, 3.
Total grate area, 75 square feet.
Boiler heating surface, 2,034 square feet.

*Weights.*

Total amount refuse consumed, 24,072 pounds.
Composition house ashes, 75 per cent., 18,054 pounds.
Wet garbage, 16 per cent., 3,852 pounds.
Rubbish, 9 per cent., 2,166 pounds.
Pounds burned per square foot grate per hour:
Grate No. 1, 89 pounds.
Grate No. 2, 73 pounds.
Grate No. 3, 71.5 pounds.
Average, 77.7 pounds.

*Water Evaporation.*

Temperature feed water, 40 degrees.
Boiler pressure (gage), 145 pounds per square inch.
Factor of evaporation, 1.227.
Total water evaporated, 29,992 pounds.
Evaporation from and at 212 degrees, 36,800 pounds.
Equivalent boiler horse power, 258.
Equivalent evaporation from and at 212 degrees per pound refuse consumed, 1.52.

*Temperatures and Pressures.*

Temperature combustion chamber, Fah.
Maximum, 1,547 degrees.
Minimum, 1,255 degrees.
Average, 1,357 degrees.
Percentage $CO_2$:
Average, 9.44.
Maximum, 12.5.
Minimum, 7.25.

Bard Avenue, West Brighton, Staten Island, N. Y. Road treated with "Tarvia B."

# Of Interest to Taxpayers

A CLOUD of dust behind an automobile means that the road surface is being destroyed—blown away. It also means that the road is unfit for modern traffic—that it has been built in the old way intended for slow-moving, horse-drawn traffic.

The science of MacAdam has been rewritten these last few years. A mineral binder is no longer enough to hold the stone together.

Something stronger is needed, and the use of Tarvia is the logical and necessary answer to a difficult problem.

In the tarviated road there is a matrix of Tarvia around each stone, holding it firmly to its work and preventing it from shifting. There is no internal movement, and the attrition of traffic is reduced to a minimum.

If the road is built with Tarvia the extra cost of the treatment is more than made up in longer life and reduced maintenance cost.

There are three kinds of Tarvia—"Tarvia X" for road and pavement construction, "Tarvia A" for surface work and "Tarvia B" for dust suppression and road preservation. The first two are very dense and viscid and require heat for application. "Tarvia B" is applied cold.

*Booklets on Request.*

BARRETT MANUFACTURING COMPANY

TRADE B MARK

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland Cincinnati Minneapolis Pittsburgh Seattle Corey, Ala.

The Paterson Mfg. Co., Ltd.—Montreal, Toronto, Winnipeg, Vancouver. St. John, Halifax, Sydney, N. S.

Air pressure in ash pit, 2.75 inches, water gage.

From regenerator, 3.75 inches, water gage.

Into regenerator, 4.25 inches, water gage.

Temperature outside air, 30 degrees.

Temperature air from regenerator, 180 degrees.

Temperature gases into regenerator, 475 degrees.

R. P. M. fan, 375.

Duration clinkering periods, 8 minutes.

Interval between clinkering periods, average, 92 minutes.

Labor cost per ton, city wages, 28 cents.

The Griscom-Spencer Co. have in hand a 50-ton Sterling destructor for Berkeley, Cal., and one of 40 tons to be operated in conjunction with the Columbus, O., municipal electric lighting plant.

## Pullar and Enzenroth

H. B. Pullar, Assoc. Am. Soc. C. E. and C. H. Enzenroth, B. S., announce the opening of their consulting laboratory at 378 Woodward Ave., Detroit, Mich.

Mr. Pullar was formerly assistant manager and chief chemist of The American Asphaltum & Rubber Co., Chicago, also chief chemist for J. F. Hill, paving contractor, and has for the past six years been in close touch with the rapid development of the paving and road industry; he has also had long experience in the testing of asphalts and bitumens, and the practical handling of these materials in the construction of roads and pavements, having made and supervised the mixes on approximately 10,000,000 square yards of bituminous roads and pavements of various types.

Mr. Enzenroth is a graduate chemical engineer of the University of Michigan and has for the past few years been associated with Mr. Pullar. He has had wide experience in the testing of different kinds of asphalts, bitumens, paints, oil, etc.

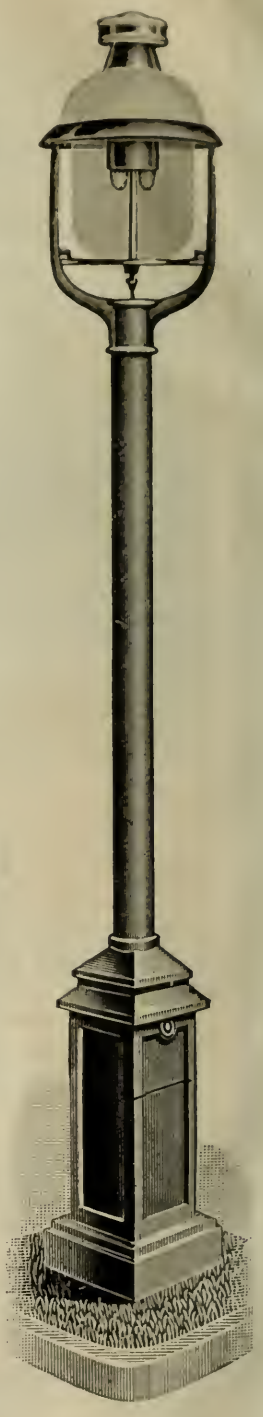
They will conduct a general testing laboratory, but will make a specialty of road and pavement inspection and the testing of bituminous materials. They have a plan for the inspection of pavements which they claim is new, practical and thoro, and will be of equal interest to engineers, city officials, contractors, and producers. They will give special attention to municipal plant work.

## Garbage Destructor for Los Angeles

Los Angeles, Cal., will open bids on June 20 for a garbage and refuse destructor plant of 450 tons capacity.

## A New Type of Street Lamp

The accompanying illustration shows a gasoline street and park lamp that is now installed in the city of Des Moines, Iowa, which city has purchased 400 of the Coleman boulevard lamps for use in their parks and outlying residence sections. They decided upon this type of park lighting because of the quantity and quality of the lights and the low cost to install and operate them.



They have been using a gasoline blinker light of about 80 to 100 candle power, but discarded them for the Coleman lamp, which when equipped with their smallest mantle produces between 250 and 300 candle power, altho where a brighter light is wanted they will use a larger mantle and more gas, obtaining in this way a light equal to the average electric arc.

The Des Moines lamps are to be taken care of by their park watchman, which adds no expense for this purpose. The quantity of gasoline used per night for midnight service is estimated to cost about two cents per lamp, with total cost for upkeep well under $10.00 per lamp per year.

The lamps are made with cast iron post, other parts of copper and brass. A gasoline tank is contained in the base of the post. Into it each day is put just enough gasoline or oil to burn the desired number of hours. By air pressure the gasoline feeds up a small copper tube to the generator between the mantles, where it is turned into vapor, which, mixed with air, forms a gas that is burned like natural or other artificial gas.

The Coleman boulevard lamp is manufactured by The Coleman Lamp Company, of Toledo, Ohio, and Wichita, Kansas. They desire correspondence with cities and villages needing anything in street lighting.

# Sewer Contractors—LISTEN!

## AT LAST—a Centering has been Perfected and it is of 100% efficiency.

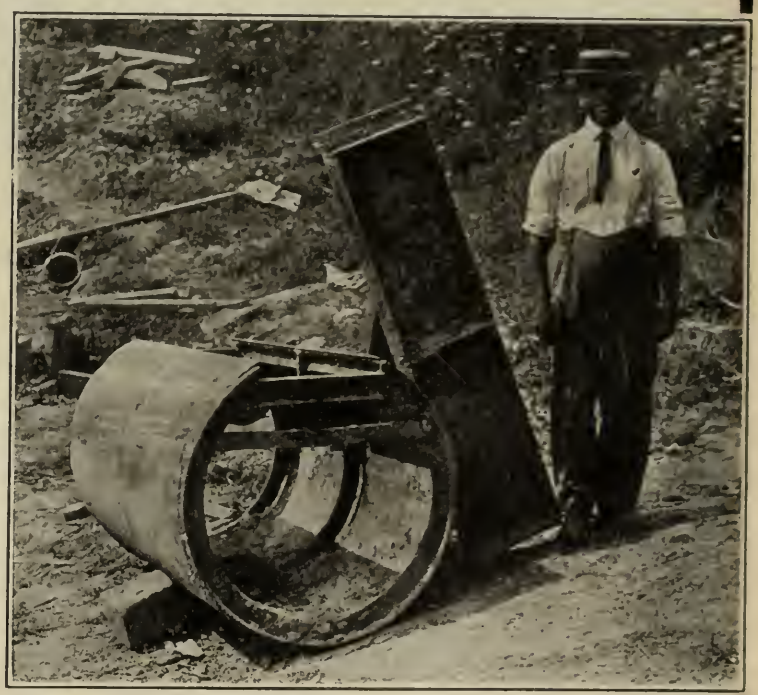
Now you can cut your costs. Now you can increase your profits. Now you can out-bid all of them, every time, and land the contract by using

## The O'Connor Collapsible Steel Centering

**FOR CONCRETE SEWERS AND CONDUITS.**

**(Patented)**

**The diameter can never vary.**



**This shows the removable section.**

Here is the record on one job where the "O'C C" Centering was used:

The Price, $158,161 as against $209,196
The Time, 200 days as against 400 days

**Reduce your labor, time and costs on your present contracts. Increase your profits away beyond anything you expected.**

Write or wire at our expense, Let us help you.

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Write for catalog today to—

## The O'Connor Collapsible Steel Centering Co.

**701 Main Street.** **HARTFORD, CONN.** **Branches** { New York, Chicago, San Francisco

## How to Obtain Best Results from Wood Block Pavements

*By H. L. Collier, C. E., St. Louis, Mo.*

If the wood blocks are treated with 20 pounds to the cubic foot with creosote oil, the specific gravity of which is around 1.14, during the first hot season after construction the blocks will bleed. The 20 pounds per cubic foot about fills the pores of the blocks and a change of temperature from 60 degrees Fahr. to 120 degrees Fahr. will cause the heavy oil to expand 10 per cent., and following the course of least resistance it will exude on the surface of the blocks. This oozing does not in the least injure the blocks, but on the contrary is a benefit to the pavement in that it fills all cracks, and makes of the filler between the blocks a waterproof mastic. The bleeding is a positive proof that the oil called for by the city engineer's specifications and certified to by the inspector at the creosote plant was forced into the blocks.

The objectionable feature of the bleeding is its stickiness, being easily tracked on to the walks and into adjacent buildings, all of which can be avoided by an occasional sprinkling of pebbly sand on the surface of the pavement during the first hot season. (It is well to remember that gasoline will remove the exuding oil from walks, floors or rugs easier than water will remove mud.

The bleeding can be avoided by the use of a lighter oil, from 1.06 to 1.10 specific gravity, and the treatment not to exceed 18 pounds per cubic foot under a pressure of from 100 to 150 pounds per square inch applied *slowly*.

The buckling of wood blocks is the least expensive, the least harmful and the easiest remedied of anything that can happen to any pavement.

In a buckle no block is injured and any laborer with ordinary intelligence with a hatchet can replace the blocks and make the pavement look as well as when first laid. The foundation is in no wise affected by a buckle. The blocks are easily removed and relaid, the last two or three being trimmed slightly so as to fit snugly, not too tight, and sand thrown over the repaired area or an asphalt cement filler used.

A buckle does not necessarily belong to the pavement; is as easily avoided, and not nearly so expensive or troublesome as blow-ups in brick or waves on asphalt or bitulithic paving. It is necessary to provide proper expansion joints.

The most fruitful sources of buckles on a wood block pavement are transverse expansion joints. They are not safety valves to prevent, but rather direct causes of buckles. The evil effect is apparent on all pavements where used in every city, and why they are still used I cannot understand.

Mr. G. W. Tillson, former chief engineer of New York, now consulting engineer of Brooklyn, has has wood block pavement closely laid both transversely and longitudinally, with no expansion joints and he told the writer in February, 1913, that he has had no buckles either in New York or Brooklyn.

My preference is to lay the blocks with close joints sidewise, with ⅛-inch joint between the ends of the blocks, and ample expansion joints at the curbs with an asphalt cement filler or specially prepared paving pitch which will not melt under the summer's heat or become brittle from the winter's cold.

Creosoted wood block paving is slippery if not clean, when slightly damp from heavy dew, light frost or snow, but not more slippery than asphalt, bitulithic, or brick with cement filler under the same climatic conditions.

To a large extent the slipperiness can be overcome by laying the pavement as nearly flat transversely as the longitudinal grade will admit, not more than ¼-inch to the foot from center to curb, better less.

Between street car rails, and between the tracks where doubled, the pavement should be laid flat transversely and on a level with the top of the rails.

Recently in Newark, N. J., the question of repaving Broad street was under discussion before the Broad Street Merchants' Association and the question of slipperiness was carefully considered.

There is in the city a drive known as "Plank Road" where a part is paved with granite block and a part with wood. An account of observations made during the week ending January 18, 1913, showed that of the vehicles of all kinds passing over the road, 72.2 per cent. used the wood block pavement, and only 27.8 per cent., the granite pavement; of the total rubber tired traffic, practically all of the motor truck variety, 89.3 per cent. used the wood blocks, while only 10.7 per cent. used the granite blocks. (Wood block paving was selected by Newark for Broad street repavement.)

As to the last complaint, that the pavement is easy to slight in construction, no pavement is so easily constructed and in no part of the construction can even a novice be deceived, except in the quality of the oil, which is always tested by an expert employed by the city. As to the penetration of the blocks, values are not destroyed if a thousand blocks are halved with a sharp hatchet, which will so disclose the degree of the penetration and the soundness of the timber as to enable any one to determine whether or not the specifications have been carried

# LIGHT

## is the Modern Commercial Power that Builds Communities

Wherever you see a well lighted city, there you'll find a growing, progressive community. **"More Light and Better Light"** is the watch word of the thriving towns of America. The greatest example of the power of light is illustrated daily in the busy centers of New York and Chicago. It is a proven fact that crowds follow the light, and this principle applied to a community produces wonderful results. You can make for a bigger and better city if you will study the profitable results secured by high efficiency in the lighting problem of your streets. Let us give you facts and figures for the "Murray-izing" and better lighting of your town.

**MURRAY IRON WORKS**

**BURLINGTON, IOWA.**

out. Every engineer reserves the right to make these physical tests after the blocks have been delivered on the street to be paved.

The concrete foundation is the same under all pavements and because of the ease with which wood blocks are trimmed to fit they are very much more easily laid than brick or granite blocks.

## Trade Notes

C. Wadsworth has established an office at 961-3 Woodward Ave., Detroit, Mich., to represent manufacturers of contractors' machinery and materials, especially municipal contractors.

The Architects Samples Co., Inc., has opened offices in the Architects building, Park Ave. and 40th St., New York, to provide for display of requested samples, delivery of same to architects' offices, to obtain information regarding materials, to prepare and issue bulletins and to keep catalogs for reference and distribution.

John Wiley & Sons, Inc., the well-known technical-book publishers, have removed their business to 432 Fourth Ave., corner of 29th street, New York City.

The Raymond Concrete Pile Co., has been awarded contracts for placing piles for the foundations of the new boiler house and laundry building on Randall's Island, New York; a new warehouse for S. J. Van Lill Co., Baltimore, Md.; and a crane runway for the Crucible Steel Co. of America, at its LaBelle works.

Metcalf and Eddy, civil engineers, Boston, Mass., have admitted to partnership several of their employes, including Charles W. Sherman, principal assistant, William T. Barnes, in charge of Chicago office, and Almon L. Fales.

Citizens of New Carlisle, Ind., have just voted unanimously for the construction of 12 miles of concrete highway. The Universal Portland Cement Co., is to write the specifications and the roadway will be 9 feet wide with 3-foot gravel shoulders. This work came as the result of an inspection of the concrete roads at Buchanan, Mich.

Bids were opened recently for 30,000 yards of concrete pavement to be placed at South Bend, Ind. This is the first installment on more extensive work of the same kind contemplated for the summer.

The city of Des Moines, Iowa, thru its "Greater Des Moines Committee," issues some of the most satisfactory city advertising literature which is received at this office, because it is reasonable and accurate and does not claim everything in and out of sight.

D. B. Luten is distributing the final decree, the eighteenth he has received on his patents, adjudging valid the twelve patents included in the suit, requiring Gaffey and Byrnes, the defendants to pay him royalty of 10 per cent. on the contract price of the infringing structure, and enjoining them from building other infringing structures.

The sole agency for the Johnston sprayer, and Kent's oil heater and forcer has been secured by Wm. F. Irish, engineers. With the good combination of an aggressive, capable manager in Mr. Irish, a large and efficient sales force and two fully proven speccialties of such merit and value as these, busy times are assured in the handsomely furnished "Irish Headquarters," away up on the 28th floor of the Whitehall Building (Room 2842), New York.

## Trade Publications

The Kewanee Boiler Co., Kewanee, Ill., publishes "Evidence" of the efficiency and economy of Kewanee smokeless fire box boilers.

Bulletin No. 10 on the Illmer gas engine has been issued by the Reading Iron Co., Reading, Pa.

We are in receipt of advance sheets of the new illustrated catalog of the Heer Engine Co., Portsmouth, O., which fully describes their traction engine as applied to road making, including scraping, grading, rooting, placing, hauling and running other machinery, such as crushers, mixers, etc.

Keuffel & Esser Co. issue a descriptive price list of planimeters and their appurtenances from Hoboken, N. J.

Bulletin No. 34-L, of the Chicago Pneumatic Tool Company's Compressor Department treats particularly of general engineering information of value to users of compressed air. It contains tables giving efficiencies of air compression at different altitudes, density of gases and vapors, mean effective pressures and horse powers, loss of pressure due to friction in pipes, and many others, some rare and all important; also information for intending purchasers, showing the data required for intelligent estimates. Views of various types of compressors are shown in miniature, as well as illustrations showing the interior of the Pneumatic Tool Company's Compressor Plant at Franklin, Pa. It will be sent upon application to the company, Fisher Building, Chicago, or No. 50 Church St., New York City, or any of its branches in all large cities.

The Koehring Machine Co., Milwaukee, Wis., issue a monthly publication entitled "The Mixer."

The Chain Belt Co., Milwaukee, Wis., issue their "Chain Belt" monthly, the April number showing their new foundry.

"The Jewell Bulletin" gives monthly news of the stock and business of the

# Coldwell Lawn Mowers

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COLDWELL LAWN MOWER COMPANY
Philadelphia NEWBURGH, NEW YORK Chicago

Jewell Nursery Co., Lake City, Minn.

"The J-M Power Expert" of the H. W. Johns-Manville Co., for May shows the new turbine plant of the Cleveland Electric Illuminating Co.

The Producers' Gas Engine is a product of the Producers' Supply Co., Franklin, Pa., described in a recent circular.

Catalog 33 of The C. D. Bartlett & Sons Co., Cleveland, O., shows the various styles of their Universal crane and excavator.

"Channon's Review" is a medium of communication to H. Channon Co., Chicago, Ill., with their customers.

Weber coniform reinforced concrete chimneys and their construction are quite fully described in a booklet on "Weber Chimneys" published by the Weber Chimney Co., Chicago, Ill.

The saving from using a Kewanee water heating garbage burner is set forth in a pamphlet issued by the Kewanee Boiler Co., Kewanee, Ill.

The General Fireproofing Co., Youngstown, O., issue a circular on their Allsteel filing drawers, cases, cabinets and safes.

Daniel B. Luten, designing and consulting engineer, Indianapolis, Ind., was very commendably prompt in issuing a booklet on "Reinforced Concrete Bridges in the Easter Flood," which shows the differences in stability between bridges of Luten design and many others.

Bulletin No. 3 of the Hoskins Mfg. Co., 453 Lawton Ave., Detroit, describes the Hoskins thermo-electric pyrometers.

The Turbine Sewer Machine Renovating Co., 197 11th St., Milwaukee, Wis., issue a fully illustrated booklet showing the work which has been done by their turbine sewer cleaning machine in removing serious stoppages from sewers.

Joseph A. Anglada, M. E., 1790 Broadway, N. Y., has issued a pamphlet on denatured alcohol as a decarbonizer and engine cleanser.

Samuel Cabot, Inc., Boston, Mass., publish a handsome reproduction of a photograph of the first suspension bridge in America and a pamphlet describing "Conservo" wood preservative used on the wood employed in restoring the bridge recently.

Spray Engineering Co., Boston, Mass., publish a fully illustrated bulletin, No. 51, descriptive of their air washers, laying stress on the nozzle.

The Griscom-Russell Co. have published special bulletin 704 giving report of official tests of a Sterling refuse destructor installed at Halifax, N. S.

The Crosby Steam Gage and Valve Co., Boston, Mass., issue a valuable cloth bound book of 201 pages entitled "Practical Instructions relating to the construction and use of the steam engine indicator."

We are indebted to Wm. F. Irish, 2842 Whitehall Building, New York, for a 56-page fully illustrated book, "The Construction and Maintenance of Roads." While this book modestly advocates the use of certain road and street making machines, it is notably of value for the exhaustive and authoritative manner in which it presents and solves many road making problems. The author, J. A. Johnston, is well known for his successful record as engineer on the Massachusetts State Highway Commission.

## Publications Received

Report of State Roads Commission of Maryland for 1908 to 1911, inclusive. W. W. Crosby, Chief Engineer, Baltimore, Md.

Sixteenth biennial report of the State Engineer of Colorado for 1911-12. Charles W. Comstock, State Engineer.

Memoir by the Prefect of the Seine to the municipal council, and reports upon the annexation of the military zone to the city of Paris and transfer of the fortifications to the city for public and ornamental purposes, with memoranda of agreements between the city and the French government rendering the project possible. Marcel Delanney, Prefect of the Seine, acting for the city of Paris, and Alexander Millerand, minister of war and M. Klotz, minister of finance, acting for the state.

Eighteenth annual report of the Board of Public Works, Little Falls, N. Y., for 1912. Frank H. Shall, Mayor; O. J. Dempster, City Engineer.

Report on the Improvement and Development of the Transportation Facilities of San Francisco. Cloth, 469 pp. with many illustrations. Charts, tables, etc. $1. By Bion J. Arnold, consulting engineer, Chicago, Ill.

A Study of the Organization and Procedure of Each Permanent Board, Commission, Committee and Office, except those concerned with courts, education and elections, in the city of Bridgeport, Conn., by Peter White, C. P. A.

Twentieth Annual Report of the Board of Electrical Commissioners of South Norwalk, Conn., 1912. A. E. Winchester, Gen. Supt.

Asphalt Construction for Pavements and Highways. A pocket book for engineers, contractors and inspectors, by Clifford Richardson, consulting engineer, M. Am. Soc. C. E., F. C. S. Leather, 155 pp. $2, net. McGraw-Hill Book Co., 239 W. 39th St., New York.

Specifications for Street Roadway Pavements, with instructions to inspectors on street paving work, by S. Whinery, M. Am. Soc. C. E. Cloth, 116 pp. $1, net. McGraw-Hill Book Co., 239 W. 39th St., New York.

Third biennial report of the Department of Engineering of California, 1911-

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## THE SEAGRAVE COMPANY
COLUMBUS, OHIO.

12. W. F. McClure, State Engineer; Austin B. Fletcher, State Highway Engineer.

Fourth Annual report of the Department of Water, San Diego, Cal. Hubert R. Fay, councilman, superintendent; H. A. Whitney, asst. supt. and engineer.

Special Report of the Comptroller of the city of St. Louis, transmitting report of the bureau for revision of accounts and methods. B. J. Taussig, Comptroller.

American Civil Engineers' Pocket Book. Editor in Chief, Mansfield Merriman. Associate Editors: I. O. Baker, A. H. Blanchard, C. B. Breed, W. J. Douglas, L. A. Fischer, G. A. Goodenough, A. Hazen, F. P. McKibben, E. R. Maurer, R. P. Miller, A. Noble, F. E. Turneaure, W. L. Webb, G. S. Williams. Leather, 1473 pp. $5.

Annual report Division of Sewage Disposal, Columbus, O. C. B. Hoover, chemist in charge of sewage purification works.

Practical Methods of Sewage Disposal for residences, hotels and institutions. By Henry N. Ogden, M. Am. Soc. C. E., professor of sanitary engineering, Cornell Univ., and H. Burdett Cleveland, Assoc. M. Am. Soc. C. E., principal assistant engineer, N. Y. State Department of Health. Cloth, 132 pp. John Wiley & Sons, New York.

Highway Engineering as presented at the second international road congress, Brussels, 1910. By Arthur H. Blanchard, C. E., A. M., professor of highway engineering, Columbia Univ., consulting highway engineer, M. Am. Soc. C. E., etc., and Henry B. Drowne, C. E., instructor and assistant, Assoc. M. Am. Soc. C. E., etc. Cloth, 299 pp. $2, net. John Wiley & Sons, New York.

Street Pavements and Paving Materials; a manual of city pavements, the methods and materials of their construction, for the use of students, engineers, and city officials. By Geo. W. Tillson, C. E., consulting engineer to the borough president of Brooklyn, M. Am. Soc. C. E., Am. Soc. Mun. Imp., etc. Cloth, 651 pp., $4, net. John Wiley & Sons, New York.

Building Stones and Clay Products; a handbook for architects. By Heinrich Ries, Ph. D., professor of Economic geology in Cornell Univ., F. G. S. A., M. A. I. M. E., etc. Cloth, 415 pp., $3, net. John Wiley & Sons, New York.

Concrete Costs; tables and recommendations for estimating the time and cost of labor operations in concrete construction and for introducing economical methods of management. By Frederick W. Taylor, M. E., Sc. D., and Sanford E. Thompson, S. B., M. Am. Soc. C. E., consulting engineer; authors of A Treatise on Concrete, Plain and Reinforced. Cloth, 709 pp. John Wiley & Sons, New York.

Shade Trees in Towns and Cities; their selection, planting, and care as applied to the art of street decoration; their diseases and remedies; their municipal control and supervision. By William Solotaroff, B. S., secretary and superintendent of the shade-tree commission of East Orange, N. J. Cloth, 287 pp., $3, net. John Wiley & Sons, New York.

A Textbook on Roads and Pavements. By Frederick P. Spalding, professor of civil engineering, Univ. of Missouri, M. Am. Soc. C. E. Cloth, 408 pp., $2, net. John Wiley & Sons, New York.

The Subways and Tunnels of New York; methods and costs; with an appendix on tunneling machinery and methods, and tables of engineering data. By Gilbert H. Gilbert, Lucius L. Wightman and W. L. Saunders. Cloth, 372 pp., $4, net. John Wiley & Sons, New York.

Report of Chemical and Biological Survey of the Waters of Illinois for 1911. Edward Bartow, Urbana, director. Paper, 173 pp.

Annual report of the water works of Milwaukee, Wis., for 1912. H. P. Bohmann, supt.

Forty-seventh annual report of the water commissioners of Newburg, N. Y., for 1912. Curtis Stanton, supt.

Principles and Practice of Surveying. By Breed and Hosmer of the Massachusetts Institute of Technology. Vol. I, elementary, $3; Vol. II, higher, $2.50.

Lefax, Vol. 3, No. 3. Subscriptions on basis of $2 for 200 sheets. Standard Cooperation, Penna Bldg., Philadelphia, Pa.

Nineteenth annual report of Water Board of Auburn, N. Y. J. Walter Ackerman, Chief Engineer and Superintendent.

Public Road Systems of Foreign Countries and of the Several States. Prepared under the direction of Hon. Jonathan Bourne, Jr., chairman of the joint committee on Federal Aid in the construction of public roads for the use of the Committee, April 24, 1913. Government Printing Office, Washington, D. C.

Forms for Special Assessments, Illinois. Prepared and compiled by A. H. Baer, Belleville, Ill., for the use and guidance of municipal engineers of the state of Illinois. Published by the National Paving Brick Manufacturers' Association, B. of L. E. bldg., Cleveland, O.

Plane Surveying by J. C. Tracy, C. E., of the Department of Civil Engineering, Sheffield, Scientific School of Yale University. Leather pocketbook, nearly 800 pp., $3. John Wiley & Sons, New York.

Wisconsin Railroad Commission Reports, Vol. 7, June-Sept., 1911, 863 pp.; Vol. 8, Sept., 1911-Mar. 1912, 887 pp. John Roemer, chairman, Madison, Wis.

Fourth report of the Illinois Highway Commission, for 1910, 1911, 1912. A. N. Johnson, state engineer, Springfield, Ill. Paper, 345 pp.